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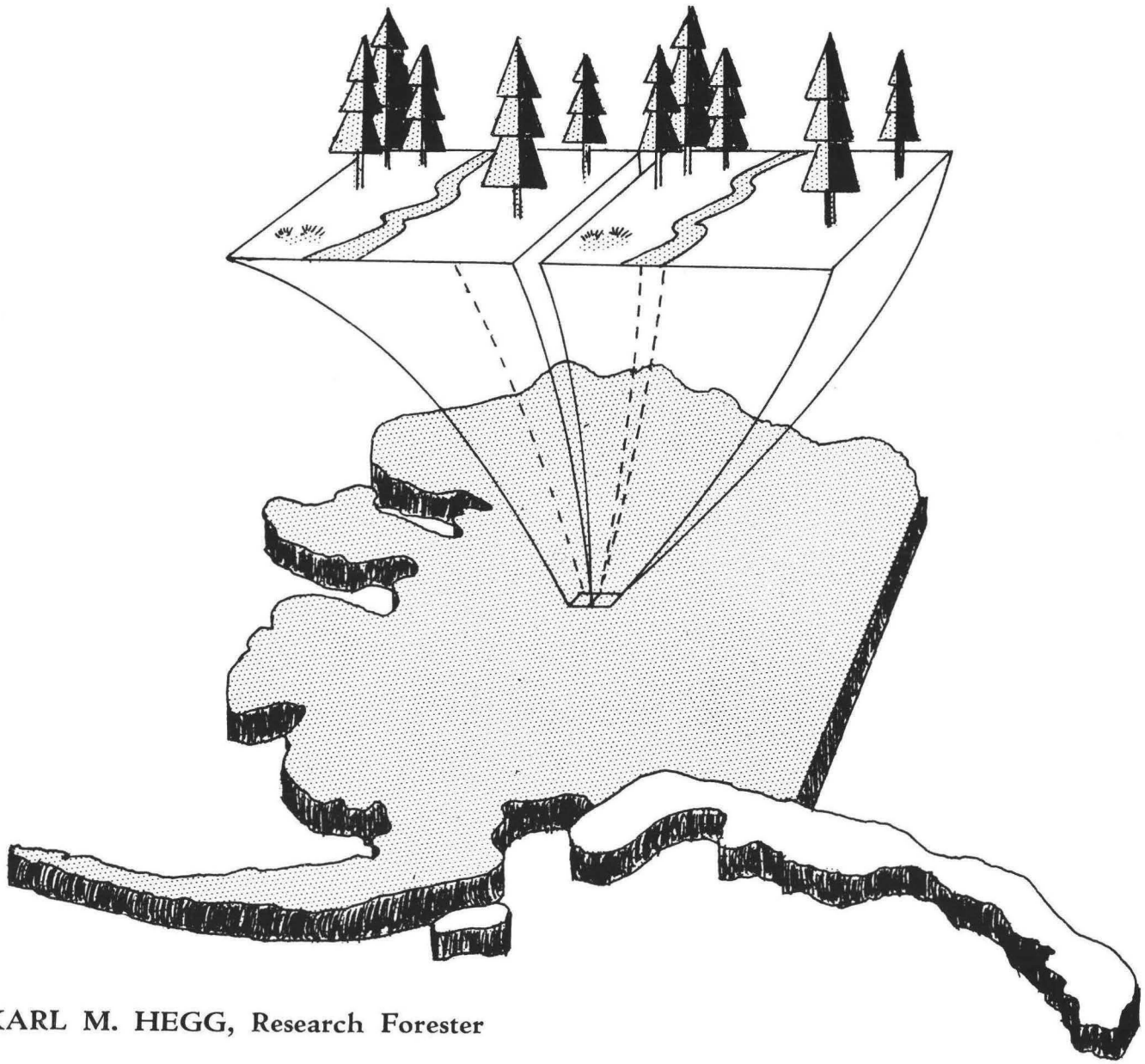
A PHOTO IDENTIFICATION GUIDE FOR THE LAND AND FOREST TYPES OF INTERIOR ALASKA



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INTRODUCTION

Planning for the initial survey of the forest resources of interior Alaska began in 1956. The survey area encompassed 229 million acres reaching from the Canadian border in the east to Norton Sound in the west, and from the Kenai-Chugach Mountains in the south to the Brooks Range in the north (fig. 1). The east-west distance is 650 miles and the north-south distance 550 miles. The Alaska Range divides the survey area into two distinct sections. The southern portion, draining into the Gulf of Alaska, has a moderate climate, adequate precipitation (15-45 inches), and little or no permafrost. The area north of the Range is a zone of wide temperature variations, low precipitation (10-15 inches), and continuous to discontinuous permafrost. In spite of these large geographic and climatic variations, the same species groups are found throughout this area (fig. 1).

Because of the large acreage involved, the normal inventory procedure using complete photo coverage with a large ground sample was too costly. The available small-scale photography was unsuitable for forest inventory purposes and complete photo coverage at a useful scale would have been extremely expensive; instead, continuous strips of large-scale aerial photos were obtained at 30-mile intervals intersecting the major drainages. A "triple sampling" design of photo interpretation/photo measurements, a proportional air check, and a small ground sample drawn from the air check were employed in this survey. Major emphasis was thus placed on photo identification of land and forest types and photo measurements of stand height and density. Studies were conducted to determine the best scale and type of photography to be used. A photo scale of 1:5,000 was selected as the best suited for accurate photo measurements. 1/ Three film types--panchromatic, modified infrared, and color --were tested for ease and accuracy of interpretation. Although each type had its merits, modified infrared was chosen because of a small gain in accuracy and the greater ease in differentiating hardwoods from softwoods -- an important consideration in this region. 2/

1/ Wilson, R. C. Working plan for the forest survey of interior Alaska. U.S. Forest Serv., Wash., D.C. 1957. (Unpublished Rep.).

2/ Haack, P. M. Evaluating color, infrared, and panchromatic aerial photos for the forest survey of interior Alaska. Photogrammetric Eng., 28: 592-98, 1962.

U.S. DEPARTMENT OF AGRICULTURE
FOREST SERVICE

ALASKA

1960
SCALE

COASTAL FORESTS
HEMLOCK - SPRUCE

NONFOREST

INTERIOR FORESTS
SPRUCE - HARDWOODS
(Well-stocked / Commercial)
SPRUCE - HARDWOODS
(Med.- poor-stocked / Noncommercial)

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Base from U. S. Geological Survey map of Alaska (Map E)

Forest areas (with revisions) from: Taylor and Little, Agricultural Handbook No. 1 and Sigafoos, Geological Survey Bulletin 1061 E

Figure 1.

MODIFIED INFRARED PHOTO CHARACTERISTICS 3/

Photographic Tone

The variations of tones on modified infrared photos result from the degree of reflectiveness of longer red and infrared wavelengths by the object. A prime reason for using modified infrared film in this region is the low infrared reflectance of conifers and the high reflectance of hardwoods. Conifers usually photograph dark grey to black, while deciduous trees photograph in varying degrees of white to grey. Unfortunately, young stands of softwoods and hardwoods and brightly lit conifer tree tips photograph with much the same light tone (fig. 26). The interpreter must then use the characteristics of shadow, texture, shape, and size, and especially physiographic location to complete the identification.

Tree Shadows

On modified infrared photos, shadows may both help and hinder the interpreter. Normally, shadows have a low degree of reflectance, photograph near black, and obscure many ground features. Larger trees sometimes cast shadows that screen the smaller trees from the observer and cause an underestimation of density or a misinterpretation of forest type. A favorable effect of shadows is the assistance they provide in the identification of a particular species when the shadow is projected into an opening. The spire- or cigar-shaped spruce (fig. 28), the lacy-crowned aspen (fig. 33), and the cotton-ball-shaped birch (fig. 33) may all be distinguished by the shadow they cast.

Physiographic Location and Site

Because of the existence of permafrost and the wide range of climatic conditions, there are only a few physiographic guides generally applicable to the entire area of interior Alaska and a ground acquaintance is essential. However, some common physiographic guides may be cited: balsam poplar is nearly always restricted to the proximity of flowing water; the steep (60 percent), overdrained, south-facing noses of slopes characteristically support a stunted growth of aspen with occasional admixture of white spruce; black spruce occupies the north-facing slopes and the poorly drained areas. 4/ The presence of hardwoods is generally an indicator of good drainage. In particular this applies to aspen and balsam poplar on upland sites. Birch, however, is a variable indicator. Excellent stands are found on well-drained areas on the Kenai and the Susitna and Tanana uplands, but birch is also found on wet sites either as a

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3/ For a more complete discussion of photo and infrared photo characteristics see Spurr, S. H., pp. 22-38, 179-182, Aerial photographs in forestry, New York: Ronald Press. 1948.

4/ Lutz, H. J., and Caporaso, A. P. Indicators of forest land classes in air-photo interpretation of the Alaska interior. U. S. Forest Serv., Sta. Paper No. 10, 31 pp., illus. Alaska Forest Res. Center, Juneau, Alaska. 1958.

pure stand (poor quality) or in combination with black spruce. If the interpreter notes the aspect, this problem can usually be resolved.

Texture, Shape, and Size

Recognition features of texture, shape, and size and their relation to ground cover, stand size, or volume are also much the same on any film type. These features are particularly important in distinguishing between high or low brush and wet or dry meadow. Using large-scale photos (1:5,000) it is possible to distinguish between two brush heights (plus or minus 4 feet) as well as between low brush and meadow. A pebbly short growth not showing signs of excess wetness is probably low brush. A similar area in western Alaska, but showing signs of moisture between clumps, may be wet meadow. Pictures and stereograms in the key illustrate this (figs. 6, 7, 8).

Texture and image size play an important part in the determination of stand size. The use of size alone can lead to a false conclusion. For example, dense 70- to 75-foot birch and aspen stands would be identified as sawtimber based on height alone. Using the combination of texture and size an interpreter would note the crown size and high density and, from his knowledge of such conditions, classify this stand as poletimber.

Some Comparative Textures

Very fine--water, grass, low brush, cultivated fields.

Fine--dense stands of willow and alder brush, dense stands of hardwood or conifer seedlings and saplings.

Medium--pole stands and small-crowned dense sawtimber.

Coarse--mature sawtimber of medium density.

Very coarse--overmature timber, open-grown sawtimber, and partially cut stands.

CLASSIFICATION OF LAND AND LOCAL TYPES

Three major land classifications: commercial forest land (CFL), noncommercial forest land (NCFL), and nonforest land (NF), have been used in the key. These land classes have been further divided into local cover types that are, in most cases, as specified in the Forest Service Handbook.[5/] There are, however, a few instances of conditions peculiar to the interior Alaska region that require modification.

Commercial Forest Land

Elevational limits of tree growth in Alaska's interior range from 500 feet in the north and west to a maximum of 3,500 feet in the south. The range of commercial tree growth is much less. The normal limit is at about 2,500 feet elevation, with the best growth restricted to bands along rivers, depositional zones at the bases of slopes, and well-drained upland areas below 2,000 feet. Occasionally, commercial stands may occur as high as 3,000 feet.

5/ U. S. Forest Service. Forest Service Handbook. Title - 4800 Forest Economics Research., pp. 109 - 118, 1960.

Spruce Type

Both white spruce (Picea glauca (Moench) Voss) and black spruce (Picea mariana (Mill.) B.S.P.) occur in the spruce type with black spruce a minor component. This mixture can occur on well-drained upland sites after a burn and sometimes may be recognized by the wide variation in heights. Differentiation between the two species is usually difficult on good sites and has not been attempted in the key. On commercial sites the following recognition characteristics are common to both: Spruce photographs dark grey to black, its cigar-shaped or narrowly triangular shadow near black. The crown appears sharp or pointed and, when viewed obliquely, is spire-shaped or conical. Mature trees seldom exceed 70 to 100 feet in height (fig. 15, 26-30).

Geographically and altitudinally, white spruce is the most widespread tree species in interior Alaska. It attains its best development along river courses, upland slopes, and bases of slopes. It is also a primary invader of the arctic tundra and subalpine areas of the north and west. Because of repeated fires, pure stands are infrequent. Most stands are of mixed species with birch the most common associate. On northerly and easterly aspects, the spruce-birch mixture is restricted to drainages and bases of slopes. On other aspects this type is found on all topographic situations.

Birch Type

Included in the birch type are three varieties of paper birch (Betula papyrifera Marsh.). Since these are difficult to distinguish on the ground, no attempt will be made to separate them on the photo.

Paper birch is the most extensive hardwood species in this region. It is especially prominent on the Kenai Peninsula and the Susitna, Copper, and Tanana river drainages. The best stands are found on the low, rolling hills of the Kenai Peninsula and the Susitna drainage. This species is recognized on photographs by its whitish cotton-ball-shaped crown (figs. 38-39). Also, it is the only commercial tree species exhibiting clumpiness (clustering). After fires, birch stumps sprout profusely, producing -- as the stand ages--a characteristic circular pattern (fig. 39). Heights seldom exceed 80 feet and are usually around 60-70 feet except in western Alaska where maximum heights of 50-60 feet prevail. Paper birch occurs on all exposures, on wet or dry sites, and in combination with white or black spruce, aspen, or balsam poplar. In pure stands it is a good indicator of a commercial site. On north-facing slopes it is often found in mixture with black spruce on wet, noncommercial sites. It reaches its best development on drained southeasterly and southwesterly aspects. Mature birch stands are usually in the process of opening up, with the more shade-tolerant spruce invading the openings.

Aspen Type

Quaking aspen (Populus tremuloides Michx.) occurs mostly on upland areas, particularly on the dry south or southwest exposures. It is common over extensive areas of the Copper River drainage and the Kenai Peninsula. It is seldom found west of the Tanana-Yukon junction and the Alaska Range. The best stands occur on southerly aspects with a gentle slope and a relatively deep layer of unfrozen soil (3-6 feet). On aerial photographs, aspen

shows slightly darker grey than birch. The crown commonly occupies less than one-third of the stem and has a fuzzy or lacy texture (figs. 32, 33, 36). Aspen occurs frequently in pure, high-density, even-aged stands. This dense stocking persists in stands at all ages up to pathological maturity. Because of this high stocking percent, it presents a smooth appearance with individual crowns not easily discernible. Heights seldom exceed 70 feet. Sawtimber stands are rare, as most trees reach their pathological rotation age before attaining sawtimber size. Aspen and birch have been found to invade noncommercial black spruce sites after fire in the zone of continuous permafrost, particularly on older river terraces.

Balsam Poplar Type

Balsam poplar (Populus balsamifera L.) and black cottonwood (P. trichocarpa Torr & Gray) are combined in this type and referred to as balsam poplar. Balsam poplar follows willow and alder as a primary invader of new soils. It is characteristically associated with new alluvial soils deposited by the glaciers and larger rivers. On occasions it will spread from this normal habitat to adjacent burned-over areas and to the dry south noses of hills. This type occurs as pure stands along rivers. Further removed from drainage ways, it often is found in mixture with birch. In later stages of succession the balsam poplar type is invaded by white spruce.

Except for widely scattered pockets on the north or arctic slope of the Brooks Range, the survey area includes the western and northern limits of this species. Maximum development is reached along the Susitna River although high volume stands are found on most drainages in the survey area.

Balsam poplar appears light grey on modified infrared air photos. It is generally darker in shade than aspen or birch. Trees pole-sized and larger have a pointed tip as compared to the rounded aspen tips. The branches appear distinct and occupy more than one-third of the bole length (figs. 41-44). North of the Alaska Range heights of mature trees seldom exceed 70-80 feet, but south of the Range heights of 90-100 feet are common and maximums of 140 feet have been observed. Stand densities are high, with crown cover often exceeding 90 percent.

Noncommercial Forest Land

The total amount of noncommercial forest land in interior Alaska is about 90 million acres. The noncommercial sites are so classified because of their inability to produce merchantable crops of wood (see glossary). These sites are characterized by soil conditions of heavy clay, permafrost, or excessive dryness. Subalpine types are also classified as noncommercial and include sites which, because of climatic extremes of latitude, longitude, and elevation, are near the limit of tree growth. Recognition of the noncommercial type on air photos involves the study of physiographic site, tree size and spacing, the occurrence of the patches of grey-toned brush between trees, and -- most important -- ground acquaintance.

Spruce Type (wet lowland)

The pure black spruce type, occasionally a black spruce–tamarack

(Larix laricina (Du Roi) K. Koch) mixture, represents a physiographic climax. Such stands are about 30-35 feet tall (45-foot maximum) and 4-8 inches d.b.h. at an age of well over 100 years.

These stands are usually located on flat or gently rolling valley bottoms and on cold northerly exposures. They represent wet, cold, poorly drained, and poorly aerated conditions caused by heavy soil or by a zone of permafrost lying close to the soil surface. Stand densities are normally high but, because of the narrow crowns, they may not appear so on the photo. A two-story effect is sometimes caused by layering. Openings in the stand are occupied by low brush and moss, and register as grey patches between the trees (figs. 14-16). Tamarack may be recognized by its small, sparse, light grey-white crown. Although exhibiting hardwood photo characteristics, its normal physiographic location (wet, poorly drained) serves to identify this species.

Individual trees in a black spruce stand photograph a dark grey-black. They typically have a cigar shape with occasional "bunching out" at the top. This knob-like development may be seen by observing the tree shadow. Other observable characteristics include a tendency to a two-storied clump appearance (caused by layering-type reproduction) and bent or inclined boles (caused by shallow rooting in permafrost soils and consequent frost heaving).

Spruce Type (subalpine)

A peculiarity of the interior Alaska area is the wide elevational range of the subalpine type. Because of adverse climatic conditions the noncommercial white spruce in western and northern Alaska, at 200 feet elevation, exhibit the same appearance as the subalpine type growing at 2,500-3,500 feet in south central Alaska. This type is characterized by poor stocking and open-grown trees. Individual trees seldom exceed 30 feet in height. Branches reach to the ground and the shadow cast is triangular in shape (fig. 14). Openings in the stand are filled with willow and bog birch.

Spruce Type (offsite)

Although this classification is not commonly accepted, it is used here expressly to label sites too arid and hot for commercial tree growth but where a commercial species has invaded the site. There are two major xeric invader species in this area, aspen and white spruce, although occasionally balsam poplar may be found on dry sites. A semi-arid situation develops at lower elevations on steep (60 percent plus) south-facing slopes of river cuts. Spruce growing on these arid sites are scattered and stunted. It is extremely rare to find an individual tree as high as 30 feet. The crowns quite often branch all the way to the ground, but are much thinner than a normal open-grown tree. Offsite areas are found on steep river banks throughout the survey area; the highest frequency of occurrence is in the area south of the Alaska Range.

Hardwood Type (offsite)

Because of the pioneer characteristics of hardwood species in this area, they are frequent invaders of sites less than optimal for good growth. Aspen is our most xeric species and is the principal occupant of the dry south slopes. Occasionally, balsam poplar leaves its valley habitat and invades dry sites also. The general appearance

of both aspen and balsam poplar on these sites is much the same (figs. 17, 18). At maturity they are short (25 feet) with disproportionately large crowns. Their boles have a twisted appearance. Stocking tends to be low. This situation frequently occurs south of the Alaska Range but is less common north of the Range.

In this area two other situations of offsite also occur. One of these is the offsite balsam poplar stand on excessively dry gravel bars removed from the main drainageway. Physical recognition characteristics are the same as for aspen. Another occurrence of offsite is the black spruce site invaded by aspen or birch, which happens frequently in the upper Yukon, but also occurs in the Tanana drainage. Classifying such a site as noncommercial is admittedly questionable since it may, under a management program of cutting and burning, be perpetuated as a crop-producing site. However, such stands are presently reverting to noncommercial black spruce as the permafrost level rises closer to the soil surface because of lower levels of insolation and increasing ground insulation.

Nonforest Land

According to Forest Survey definition, nonforest land includes land that is now less than 10 percent stocked with trees (see glossary). This includes lands that have been removed from forest land by artificial means as well as land never having had a tree cover. The breakdown of this class is represented by brush, meadow, ice- and snowfields, and agricultural-urban (figs. 2, 6-10).

Brushfields

Brush is classified into high and low categories (plus or minus 4 feet). This is intended to aid the estimation of browse types available for various forms of wildlife. Physiographic location cannot be depended upon as a guide since both categories may occur on any one area. Species represented include alder (Alnus sinuata (Reg.) Rydb., A. tenuifolia Nutt.); willow (Salix spp.); and bog birch (Betula glandulosa Michx.). The photo characteristics for these species are much the same. Multiple stems are the rule and individual crowns are often indiscernible. Alder and arctic birch photograph medium grey; willow photographs light grey. Alder and willow are the main constituents of high brush whereas bog birch, with some willow and alder, characterizes low brush. Brushfields occur naturally above timberline in the high mountain valleys and in swampy areas in close proximity to black spruce and wet meadow. In western Alaska low brush is widespread in mixture with dry meadow.

Brushfields are found in the midst of many forested areas that have been burned repeatedly. They are identified as former forest land by the presence of nearby trees, pockets of trees scattered through the brush area, standing or down snags, and the fire pattern boundary. It should be kept in mind when classifying these areas that the site potential of these formerly forested lands is the prime consideration, not the present ground cover (figs. 3, 4). Whenever the brush area being examined is below 2,500 feet, it is possible that it may have been fire-caused

and originally forested. This applies in particular to the Susitna and Copper River drainages. If a fire origin is suspected, these areas should be examined carefully and, if the suspicion is confirmed, classified as nonstocked. The forest type classification should be based on the predominant species within and surrounding the area. Any hardwoods present should be given heaviest weight since they are pioneer species.

A problem may arise in differentiating hardwood seedlings and saplings from brush. The best guide in this case is texture. Hardwood young growth has a uniform texture with individual crowns occasionally identifiable. Tall brush generally has a rather clumpy appearance with the area between clumps devoid of any apparent vegetation.

Meadows (wet and dry)

Drainage is used as the basis to classify grass- and moss-covered meadow areas. Wet meadows, generally found at lower elevations, are mostly grass with standing water. Dry meadows may occur at both low and high elevations (up to 4,500 feet). Included in the dry-meadow type are moss- and lichen-covered slopes and well-drained grassy areas.

On aerial photos, dry meadows are light grey in color. Wet meadows vary from light grey to near black, depending upon the amount of moisture present (figs. 6, 7). They have no apparent height except in areas where frost heaving has elevated clumps of grass (niggerheads) to produce a brush-like appearance. On these occasions the distinction between wet and dry meadow and low brush becomes difficult. Small changes in slope, slight differences of exposure, and relationship to winds off the Bering Sea all combine to affect the distribution of these vegetational types. Within forested areas, wet meadows are usually bordered by black spruce. The area shows no evidence of ever having supported a tree cover or the potential to do so. Boundaries of these meadows follow contour lines closely since they are water-oriented; that is, they usually occur on areas with little or no slope. Dry meadows often occur on slopes and their boundaries do cross contours. Many of the dry grass meadows are the result of repeated fires. Recurring fires often cause a site deterioration; therefore, re-establishment of tree reproduction on these areas is extremely slow. Site classification of these areas should be based on evidence of past tree growth (stumps, snags, grass-covered down trees) or reproduction.

Barren, Ice Fields and Snowfields, and Urban-Agricultural

These classifications are self-explanatory: A barren class indicates the absence of any vegetative growth or less than 50 percent total ground cover, ice fields and snowfields need no explanation, and urban-agricultural is land removed from forest and other native plant cover.

TYPE IDENTIFICATION ON RECENTLY BURNED LANDS

This section is limited to identification of the plant cover on areas burned in the previous 5 years. Due to the pioneer nature of hardwood species and the serotinous cones of black

spruce, most forested areas are restocked the first year. Rarely do more than 3-5 years elapse without adequate restocking.6/ Exceptions do occur but are usually instances of repeated fires causing a site deterioration and a subsequent invasion of grass or brush. Nonforest types usually revegetate to the original cover type.

Spruce Type

A burned-over commercial spruce site may be recognized by its physiographic location, height of snags, and color of the blackened ground. These well-drained sites are mostly near rivers, upland benches, and at the base of slopes if not north-facing. Heights of snags exceed 45 feet in a mature stand, and will normally be straight with fairly heavy branches remaining on the bole. The flaking bark will probably give the bole a grey-white tone. The ground will be dark but not black. Because of the many needles and cone scales accumulated at the base of white spruce, extremely hot burning in the immediate area of the tree may produce a circular darkened area. Few standing snags remain since the white spruce is shallow-rooted and may windthrow soon after the fire, giving the impression of a blowdown unless the darkened ground is noted.

On noncommercial spruce sites, in contrast, few branches will remain except for those in a cluster at the top of the tree. Because of the heavy insulating moss cover, fires have less effect on roots than in white spruce stands, and the many remaining snags will be bent or inclined and blackened. Individual stems will be less than 35-40 feet tall. The ground cover will appear very black.

The early regeneration of the new plant cover is difficult to identify except by interpolation from remnants. Black spruce succeeds itself unless the area has been burned repeatedly; then it may revert to brush, grassland, or -- occasionally -- hardwood. White spruce may also succeed itself if an adequate seed source is nearby. Studies in similar white spruce areas indicate that spruce seed does not travel over 200-400 feet unless over crusted snow. Therefore, if the area being identified is over 400 feet from the nearest white spruce seed source, it may be assumed that the regeneration is primarily by pioneer hardwoods. On upland sites this would be birch or aspen, and on river margins it would probably be balsam poplar or birch.

Hardwood Type

Identifying recently burned or restocked commercial hardwood areas is difficult. Both site characteristics, mentioned previously, and species differences must be considered.

Birch

Where fire has occurred within the past year or two, the white multiple-bole growth pattern of birch may be seen in the standing snags. Although the boles are not observable, this same effect may be seen in miniature on restocked areas where stump sprouting

6/ For a more complete discussion on the effects of fire on forested lands see: Lutz, H. S. Ecological effects of forest fires on the interior of Alaska. pp. 18-71. U.S. Dept. of Agr. Tech. Bul. No. 1133, 121 pp., illus. 1956.

occurs following a fire. The size of these patches is small, each numbering perhaps 10 stems. At an early age each cluster will resemble a short, wide-crowned tree.

Aspen

Although it is nearly impossible to distinguish birch from aspen restocking resulting from wind-blown seeds, they may sometimes be differentiated on former burned-over hardwood stands. Aspen characteristically reproduces by root suckering. The pattern produced is roughly circular and about 10-15 feet in diameter. The greater size of the patch of aspen reproduction is one of the few ways of distinguishing between birch and aspen at this stage. Patches of living hardwood trees in a recently burned area are usually aspen. Because of the small amount of litter under an aspen stand, fires often pass through these stands doing no more than weakening the trees whereas, in birch stands, the bark is highly inflammable and there is usually a total kill.

Balsam Poplar

This thick-barked tree is the best fitted for survival of any Alaska species. Little fire damage is incurred by pole-size and larger trees because of the thick, insulating bark. When complete destruction does occur in older stands, the poplar type may be recognized by the large size of the standing or down snags and the physiographic location.

Nonforest Lands

Fires occur frequently on these sites. The plant cover is such that it usually reproduces itself. Identification of these types can only be made by close inspection of the site. Unless observed on large-scale photos, no stem details will be apparent. Identification must be based on physiographic and geographic locations and the presence or absence of trees and tree remnants.

THE PHOTO KEY

The key uses a dichotomous elimination procedure supported by photographic (stereogram) illustrations. A system of progressive couplets leads to that identification matching the situation seen on the photograph. Illustrations referred to in the key confirm the identification.

1.	Tree cover sparse, less than 10% or completely absent, no evidence of tree remnants.	See 2
1.	Tree stocking over 10% or evidence of previous stocking from tree remnants.	See 12
2.	Physiographic or stand disturbances evident such as down trees, charring, flooding, or agricultural-urban development.	See 9
2.	Physiographic or stand disturbance not evident.	See 3
3.	Vegetation absent because of natural adverse growing conditions; less than 50% ground cover.	Nonforest (NF) water, barren, glacier or icefield. Figure 2.
3.	Vegetation (brush, grass, sparse tree cover) present.	See 4
4.	Growing conditions favorable, less than 2,500 feet elevation, drainage good, aspect other than north; comparable stands in nearby areas showing good form.	See 5
4.	Unfavorable growing conditions, trees of poor form.	See 6
5.	Located on a favorable slope and aspect; occasional tall tree remnants; (a) clumpy appearance with heights to 20 feet common, or (b) ground texture appearing light grey, smooth, with no apparent stature.	CFL - Type, stand-size, and stocking dependent on nearby timbered area. Figures 3, 4.
5.	Located on silty, river meander bars or downstream side of inner bends; brush smooth and white, heights to 20 feet common; close proximity to balsam poplar. (See 33 and 36).	CFL - nonstocked-balsam poplar. Figure 5.
6.	Vegetation without apparent height; texture very fine, carpetlike.	See 7
6.	Vegetation with apparent height; texture fine to coarse, clumpy.	See 8

7. Generally occurs at low elevations; poorly drained, standing water; tone dark to light grey; edge follows contour lines, generally a black spruce border, occasional stunted black spruce present. — NF - wet meadow. Figure 6.

7. Generally occurs at high elevations or southerly sloping exposures in the treeless western area of Alaska; tone light grey to nearly white; boundaries often cross contour lines; occasional stunted spruce. — NF- dry meadow. Figure 7.

8. Heights less than 4 feet; clumpy, pebbly texture; (a uniform pebbly surface indicates sedge clumps "niggerheads."--wet meadow) light to dark tone; composed of dwarf birch, blueberry, etc. — NF - low brush.

8. Tone light grey to white; usually clumpy, but occasionally single-stem appearance; crown appears very small (willow). Tone medium to dark grey; normally clumpy in appearance (alder). Heights of either species to 30 feet. — NF - tall brush. Figures 8, 9.

9. Indication of human activities; immediate area maintained; land use or occupancy evident. — NF - urban-agricultural. Figure 10.

9. Indication of natural disturbances, fire, or flooding. — See 10

10. Flooded area, water standing; apparently of permanent nature, area inundated large. — NF - water

10. Charring of ground and tree remnants; fire-fighting activities such as tractor trails, fire lines, and cut trees present or absent. — See 11

11. Remnants barely observable, indications of clumping, branching not evident. — NF - brushland, fire. Figure 11.

11. Darkened area smooth and unbroken, remnants not observable; occurrence on either wet, poorly drained lowlands or dry mountain slopes. — NF - meadow, fire. Figure 11

12. Trees or remnants of poor form, less than 45 feet tall; (a) north aspect and/or poorly drained, (b) south aspect with over 60% slope, the slope appearing dry and unstable. — See 13

12. Trees or remnants of good form, a commercial species with moderate slope and drainage, usually under 2,500 feet elevation. — See 21

13. Physiographic or stand disturbance evident such as down trees, charring or flooding. — See 14

13. Physiographic or stand disturbance not evident. — See 17

14. Tree remnants show charring, ground cover appears darkened. May be indication of fire-fighting activities as cat trails and cut trees. — See 15

14. Indication of flooding, area small, not of a permanent nature. — NCFL - noncommercial forest land, type dependent on remnants (see key for NCFL and CFL species).

15. Usually located over 2,500 feet elevation on high plateaus and upper slopes, remnants under 45 feet, snags grey and straight, with branching to the ground; past poor stocking evident. — NCFL - subalpine-spruce, fire.

15. Usually located under 2,500 feet elevation. — See 16

16. Slope under 10% and removed from drainage ways; north-facing, cold, wet, poorly drained; remnants rarely over 45 feet, snags inclined, dark. — NCFL - black spruce, fire. Figures 12, 13.

16. Aspect south, slope over 60%, oversteepened and excessively drained; proximity of large rivers; remnants under 30 feet. (Figs. 17, 18) — NCFL - offsite aspen, fire.

17.	Usually located over 2,500 feet elevation; occurs upper slopes and high plateaus; usually less than 45 feet, crowns tapering rapidly, shadows triangular to ground; texture coarse, low density; low brush in most openings.	NCFL - spruce (subalpine). Figure 14.
17.	Usually located under 2,500 feet elevation.	See 18
18.	Occurs principally on poorly drained, cold, north-facing aspects of less than 10% slope, removed from drainage ways; crowns and shadows columnar or cigar-shaped, trees may be inclined, heights seldom over 45 feet, stocking variable; muskeg environment, brush appears as grey, grainy carpet, lichens and mosses as small, light patches; frequently with a mixture of birch.	NCFL - black spruce. Figures 15, 16
18.	Occurs on slopes other than northerly: (a) slope under 10% and adjacent to drainage ways, (b) on silty, dunelike ridges, (c) on excessively drained slopes over 60%.	See 19
19.	Located on dry, drained slopes.	See 20
19.	Located on dry, gravelly, excessively drained river bars removed from the inner bend; brush in sparse clumps under 10 feet; trees scattered and stunted; close proximity to balsam poplar stands.	NCFL - balsam poplar, offsite.
20.	Near upper limit of tree growth; slopes under 60%, dry and hot; trees seldom over 30 feet, crooked and stunted; crowns distinctly jagged and large for height, grey tone, medium coarse texture.	NCFL - balsam poplar, offsite. Figure 17
20.	Slope south-facing, over 60%, dry, hot; trees seldom over 30 feet, crooked and stunted; crowns blending, fuzzy to fluffy, light grey, texture fine to medium.	NCFL - aspen, offsite. Figure 18.

21.	Physiographic or stand disturbance evident.	See 22
21.	Physiographic or stand disturbances not evident.	See 27
22.	No charring evident; land removed from tree production by cutting, clearing, etc.	See 23
22.	Charring of ground and tree remnants evident; fire-fighting or timber salvage activities present or absent.	See 24
23.	Evidence of logging, felled trees, cat trails. etc.	CFL - type, stand-size, and stocking dependent on remnants. Use species key No. 27-44. Figure 19.
23.	Evidence of land clearing for agriculture or urban development.	NF - urban-agricultural. Figure 10.
24.	Close proximity to white spruce (see No. 28-29); snags grey and straight; usually some remnants over 45 feet; restocking to spruce possible with one seed tree per acre, nearby hardwoods a more likely source.	CFL - spruce, nonstocked. Figures 20, 21, 22.
24.	Close proximity to hardwoods; boles light colored. Branching confined to top of tree (see No. 30).	See 25
25.	Remaining branches massive, angling upward; common on well-drained river flats, lake shores, and alluvial flats; close proximity to balsam poplar; restocking by suckers and wind-borne seeds (see No. 33).	CFL - balsam poplar, nonstocked, fire.
25.	Remaining branches slender; common drained uplands.	See 26
26.	Close proximity to aspen (see No. 30), may be root suckers encircling snags.	CFL - aspen, nonstocked, fire. Figure 23.
26.	Close proximity to birch (see No. 33).	CFL - birch, nonstocked, fire. Figures 24, 25.

27.	Foliage grey to black; crowns or shadows triangular, conical or cigar-shaped and dense. Occurs in river valley bottoms, drainage ways, and toes of north slopes.	See 28
27.	Foliage white to medium; crowns or shadows not sharply tapering.	See 30
28.	Stand height under 40 feet; texture fine to medium; often with a brush or hardwood nurse crop. High reflectance of new growth may often give light tone to canopy.	CFL - spruce, seedlings and saplings. Figure 26.
28.	Stand height over 40 feet. Tone generally quite dark.	See 29
29.	Stand height 40-65 feet, well stocked to all trees; texture medium coarse.	CFL - spruce, poletimber. Figures 27, 28.
29.	Stand medium to lightly stocked with trees over 50 feet; texture medium to coarse with ragged crowns.	CFL - spruce, sawtimber. Figures 29, 30.
30.	Crowns blending, smooth, soft, and fuzzy to fluffy; tone light grey to grey; branches confined to tip; shadows are flimsy, common south aspect or on plains in large river valleys.	See 31
30.	Crowns distinct; jagged or globular.	See 33
31.	Stand height under 46 feet; texture fine, flimsy, lacelike.	CFL - aspen, seedlings and saplings. Figures 31, 32.
31.	Stand height over 46 feet; in cases of very dense stocking, sapling stands may have heights over 60 feet.	See 32
32.	Stand height 46-65 feet; well stocked to all trees; texture medium-fine (poletimber stands may, at times, exceed 70 feet when heavily stocked.)	CFL - aspen, poletimber. Figures 33, 34.
32.	Stand medium to openly stocked with trees over 60 feet; texture medium.	CFL - aspen, sawtimber. Figures 35, 36.

33. Crowns without individual branches, usually appearing compact and cottonball-like; tone white to light grey; shadow full, rounded, and extending well down bole , evidence of multiple boles. — See 34

33. Crowns irregular with distinct branching; tone light grey to grey; common on well-drained river flats, lake shores, and alluvial deposits. — See 36

34. Stand height under 46 feet; texture fine, slightly globular. — CFL - birch, seedling and sapling. Figure 37.

34. Stand height over 46 feet. — See 35

35. Stand height 46-65 feet; well stocked to all trees, texture medium. — CFL - birch, pole-timber. Figure 38.

35. Stand medium to openly stocked with trees over 60 feet tall; texture coarse. Open-grown birch in the Susitna valley and western Alaska reach sawtimber diameters at heights of 50 feet. — CFL - birch, sawtimber. Figure 39.

36. Stand height under 46 feet; texture fine; shadows long, tapering. — CFL - balsam poplar, seedling and sapling. Figure 40.

36. Stand height over 46 feet; crowns jagged, angular, massive, shadows disclose heavy branches angling upward. — See 37

37. Stand height 46-65 feet, stand well stocked to all trees; texture medium coarse. — CFL - balsam poplar, poletimber. Figures 41, 42.

37. Stand medium to lightly stocked with trees over 60 feet; texture coarse. — CFL - balsam poplar, sawtimber. Figures 43, 44.

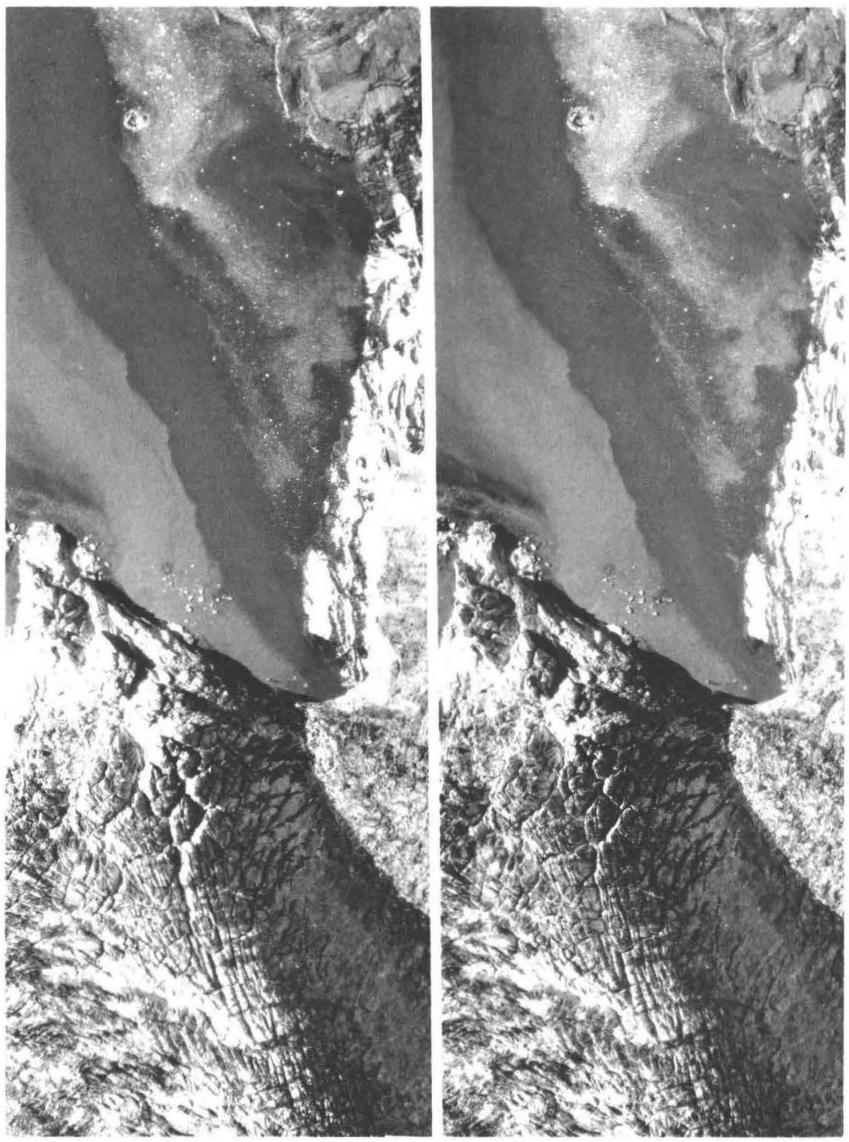


Figure 2.--Cascade Glacier, Harriman Fiord, nonforest--glacier.

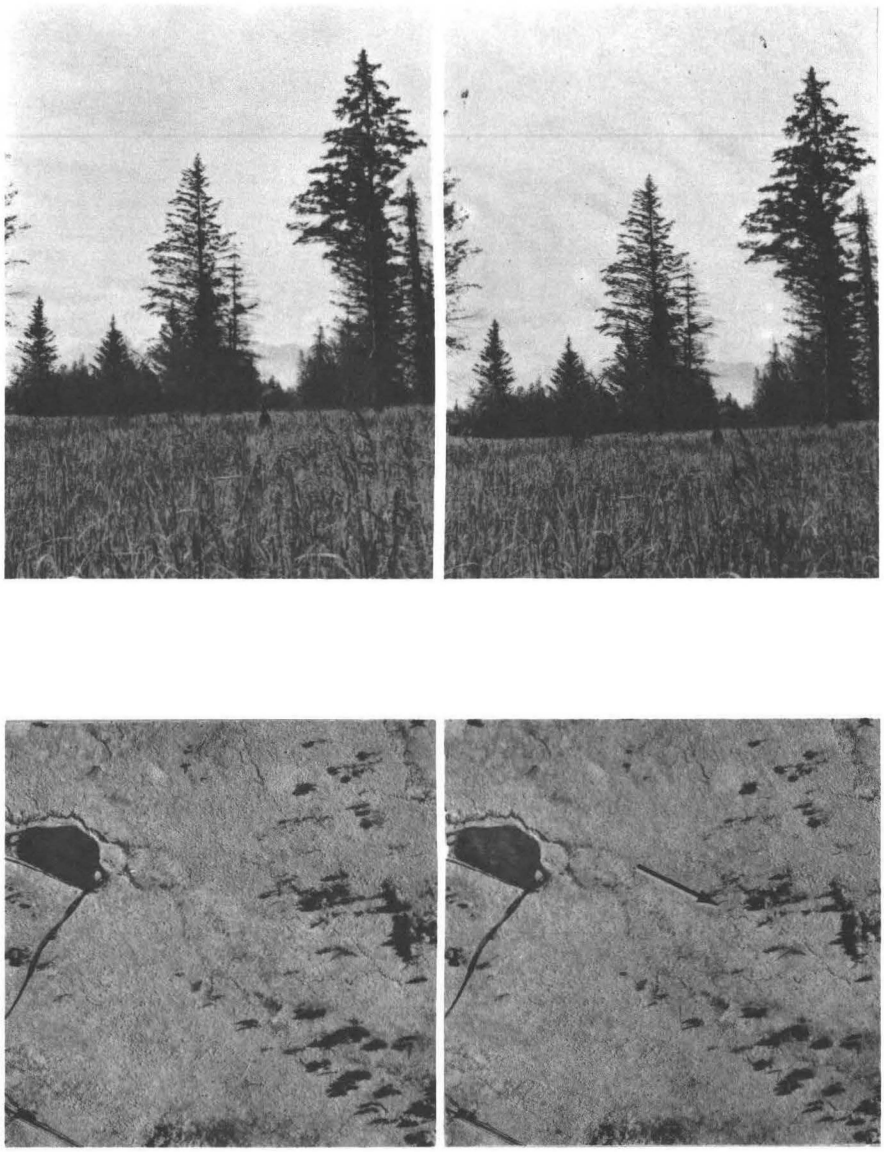


Figure 3.--Kenai Peninsula near Homer. Repeated fires have changed this from spruce CFL to grassland. In its present condition it is called non-stocked spruce; stand treatment is required to return this to forest cover. The arrow on the vertical stereo photo refers to the point from which the ground stereo was taken.

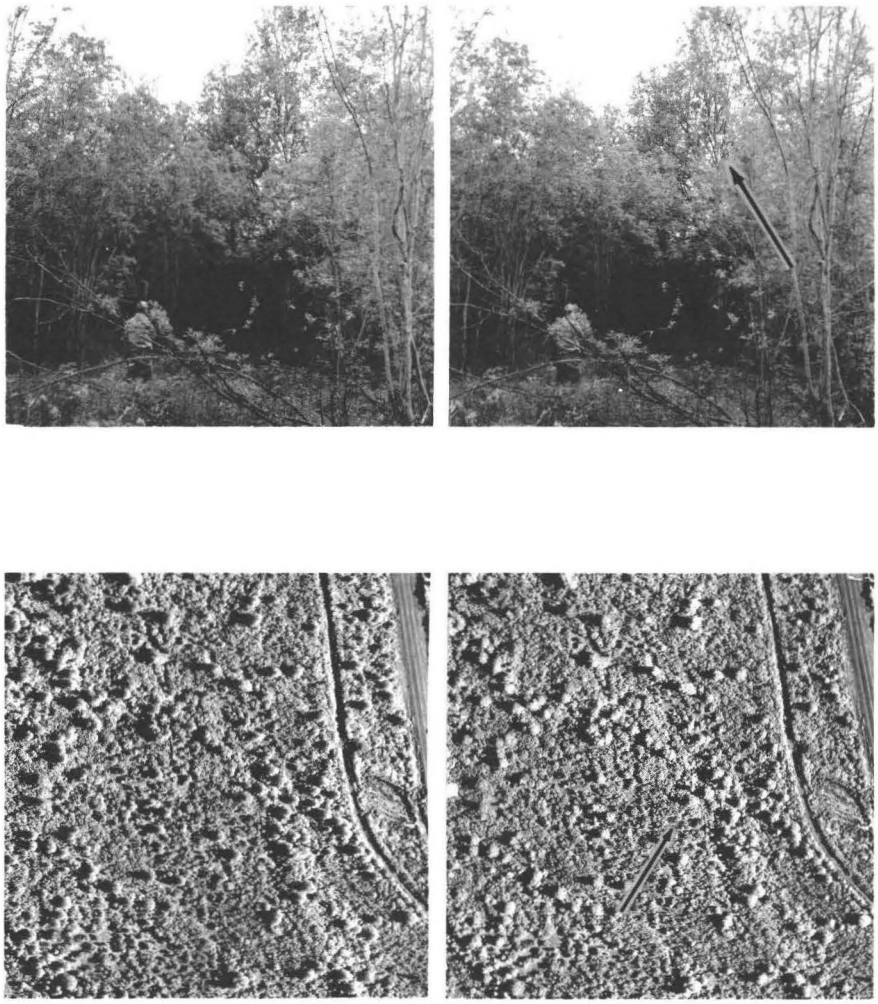


Figure 4.--Richardson Highway 15 miles northwest of Big Delta. A burned area with stocking reduced to less than 10 percent. Birch is the original type; therefore, birch-nonstocked. Tree in background is 46 years old, 14.9 inches d.b.h., and 47 feet tall.

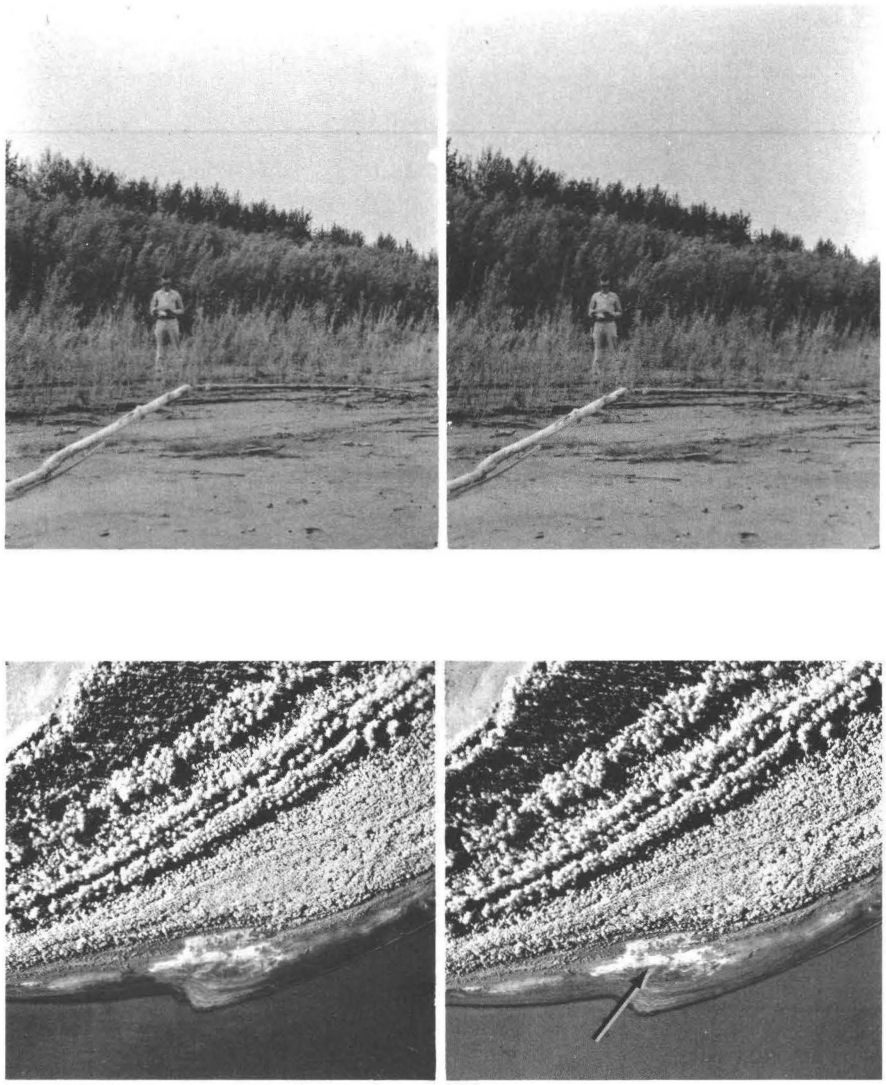


Figure 5.--Yukon River 25 miles west of Tanana. This illustrates the gradual succession from the build-up of an inner bend through a brush stage to a commercial stand. When such brush areas are above extreme high water, they are considered as CFL nonstocked. The arrow points to the site of the ground stereo.

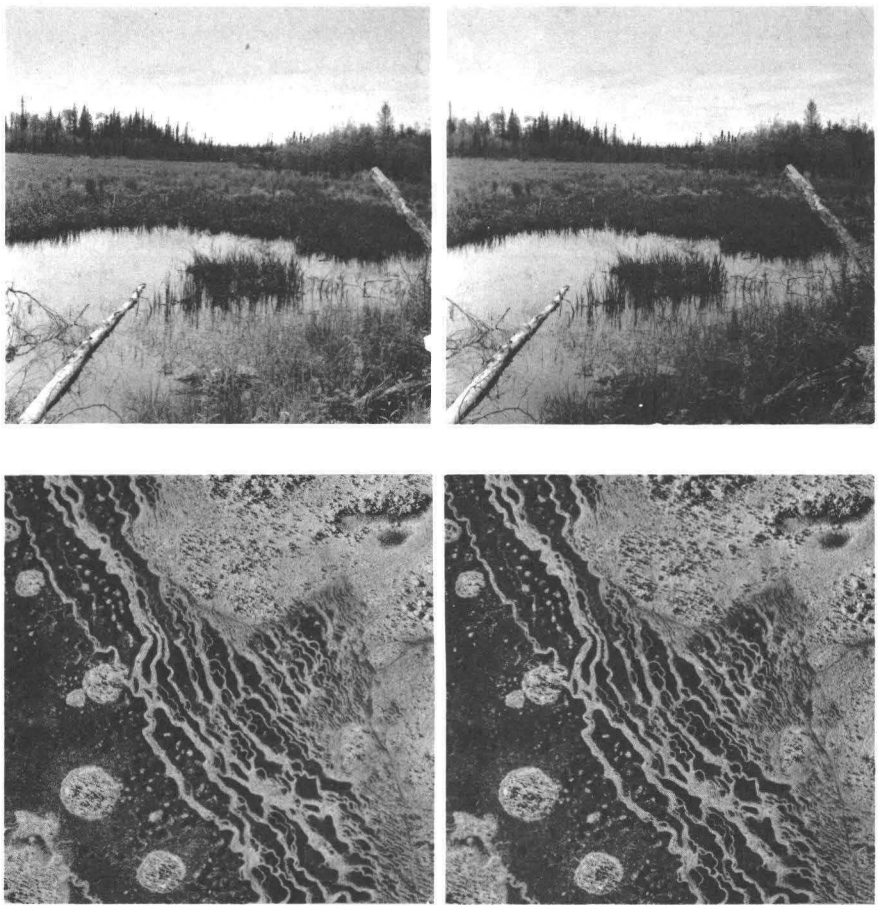


Figure 6.--A wet meadow with the typical fringe of tall brush and black spruce. This is a situation encountered most frequently in large river valleys. The vegetation is filling in the ponds, oxbows, and slow-flowing rivers.

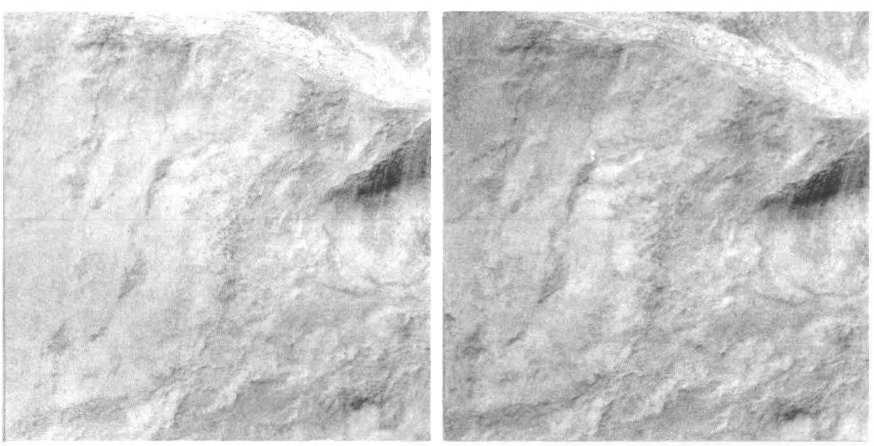


Figure 7.--An upland, dry meadow. The ground cover is a mixture of grass and lichen-moss communities. Pockets of water from melting snow and soil slumping on the steeper slopes make this type difficult to identify.

Figure 8.--Tall alder clumps on an upland site (2,500 feet elevation); near Index Lake in the Talkeetna Mountains.

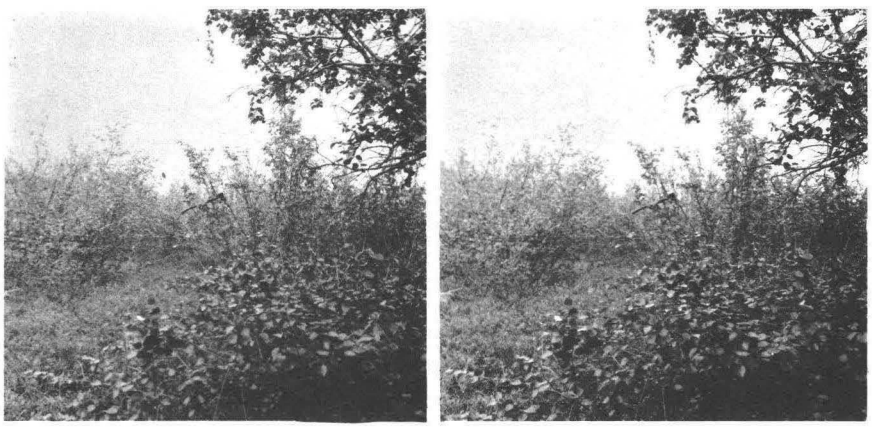


Figure 9. -- Tall alder and willow clumps with a mixture of arctic and hybrid birch. Ester Dome, north of Fairbanks; elevation 2,200 feet. For an aerial view of this area refer to figure 14.

Figure 10.--A farm in Alaska's Matanuska Valley, nonforest, urban-agricultural.

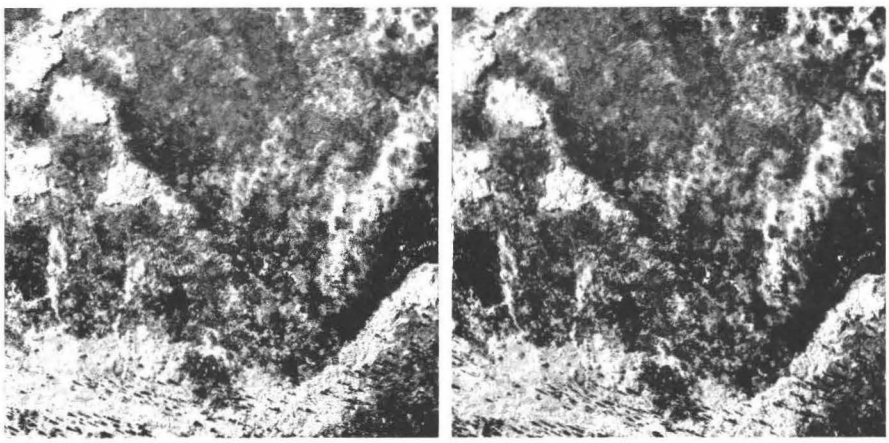


Figure 11.--A recent burn in a nonforest area. The original type was a mixture of brush and dry meadow and is expected to be of the same composition in the next cycle.

Figure 12.--A recent burn in a black spruce-muskeg type. As a result of permafrost or a high water table, black spruce is usually a shallow-rooted species. After a fire they are subject to windthrow and thus the leaning and down snags are leading indicators of this type on aerial photos.

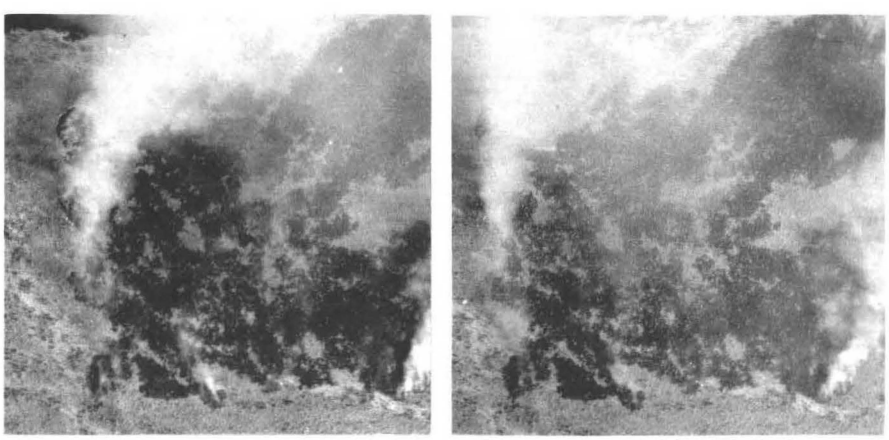


Figure 13.--An active burn in a black spruce stand. Within a year or two the leaning snags (drunken forest) will be an additional aid in identifying this type.

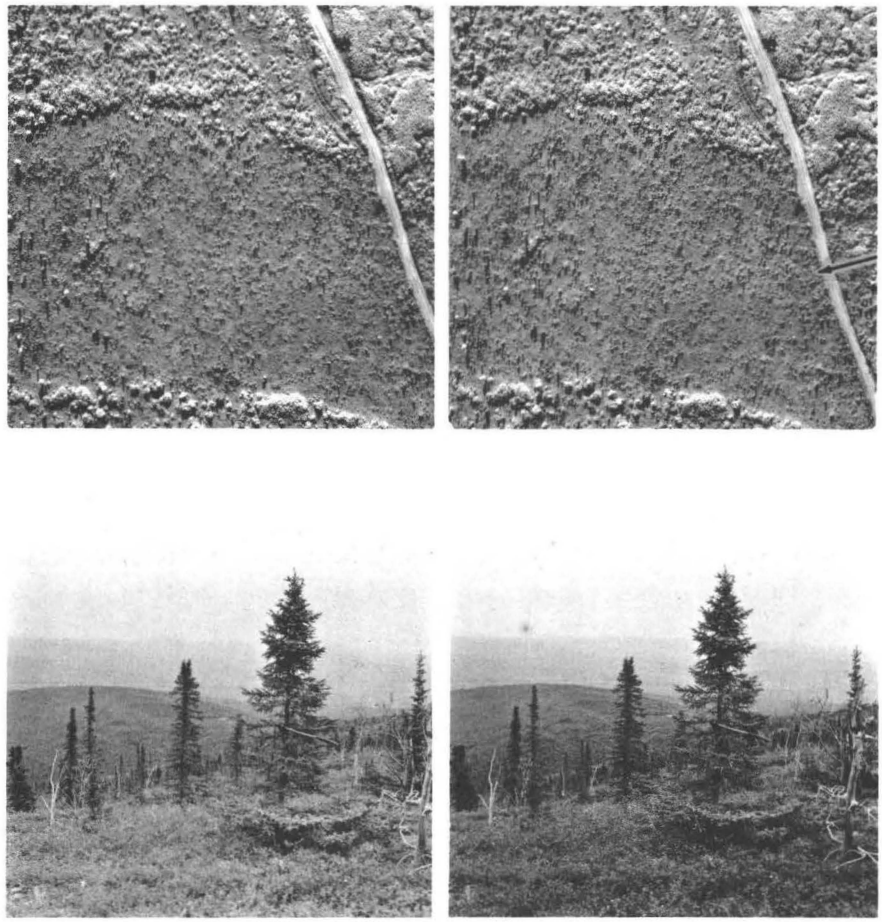


Figure 14.--Subalpine and brush (ground stereo of brush--fig. 9). Because of the climatic and geographic variations in Alaska, the subalpine type is difficult to define. This view is at 2,200 feet, a few miles north of Fairbanks. South of the Alaska Range subalpine starts at 2,500-3,000 feet. In western Alaska this situation is encountered as low as 200 feet.

This type is characterized by poor stocking and branching to the ground.

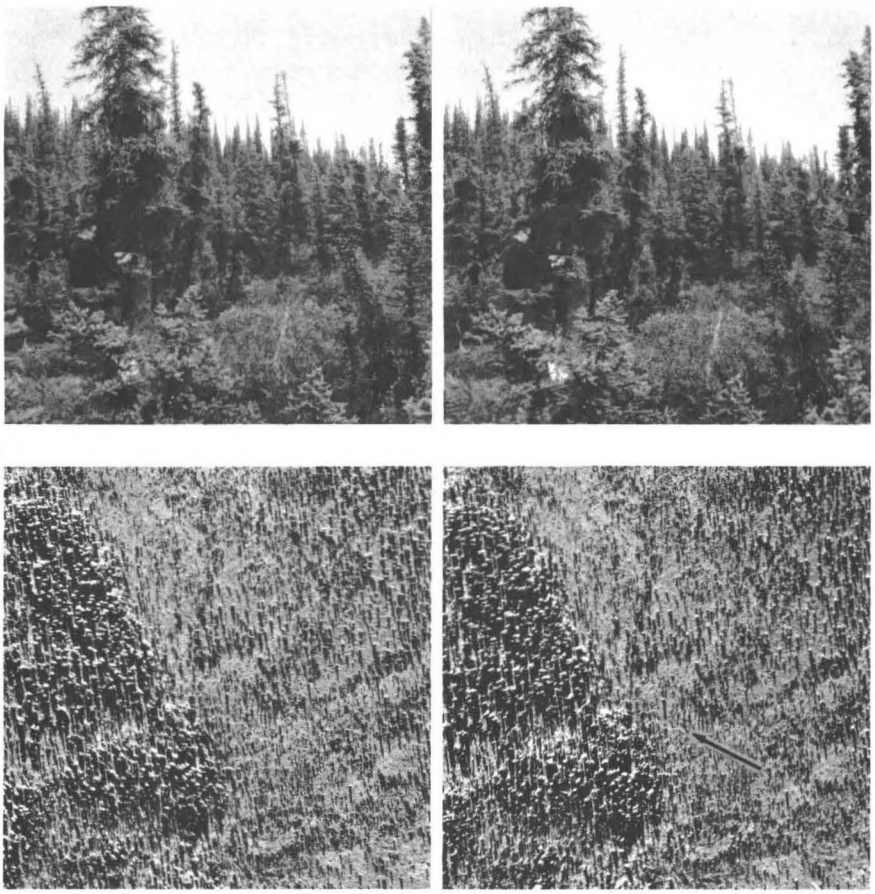


Figure 15. -- A noncommercial black spruce stand near the Glenn Highway, 40 miles east of Glennallen. These photos illustrate the site changes as affected by drainage. The black spruce type in the center and right of the air stereogram is underlain at a depth of 14 inches by drainage-restricting permafrost. The understory consists of willow and arctic birch; the ground cover is predominantly moss. The effect of improved drainage is shown at the left side of the picture where the slope is occupied by a commercial stand of white spruce underlain by permafrost at depths greater than 3 feet.

The ground stereogram below--taken near the Steese Highway north of Fairbanks--illustrates the knoblike top, consisting of cones and branchlets, characteristic of black spruce. On aerial photos this development can occasionally be seen in the shadow cast by the tree. It more often gives a deceptively large, light-toned top to the tree and might be mistaken as hardwood unless note is made of other recognition characteristics.

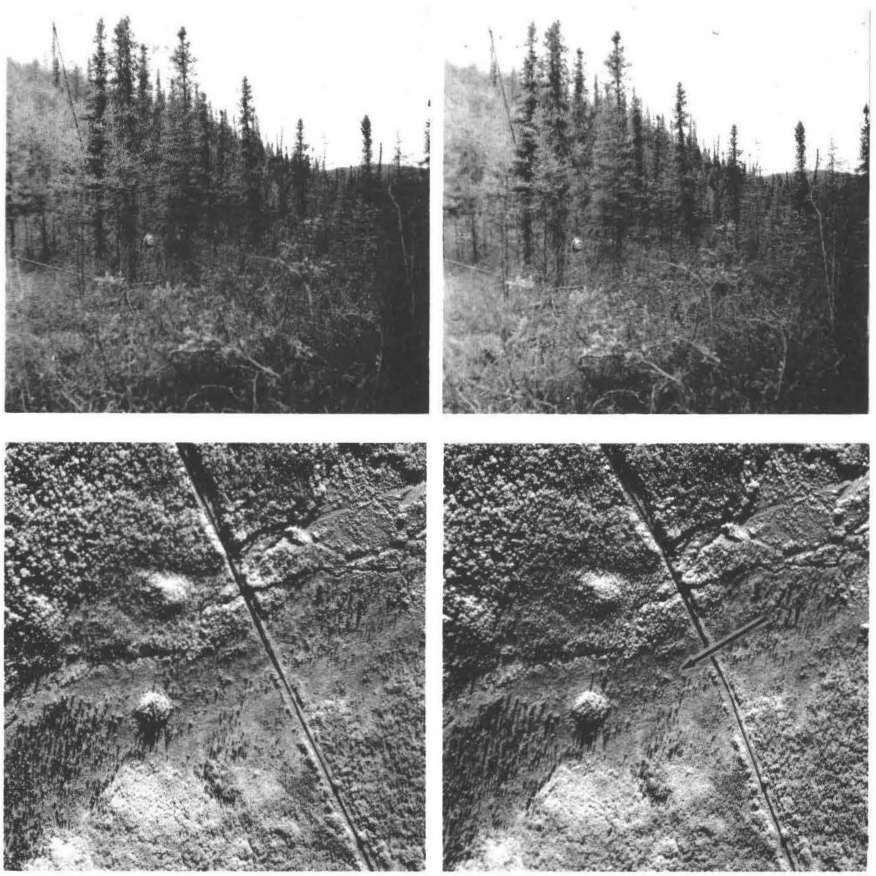


Figure 16.--Black spruce with tamarack in the foreground and aspen with a white spruce understory in the background. Hardwoods are normally indicators of good sites. Since tamarack appears white on infrared film, the site may be mistakenly classified as commercial unless consideration is given to drainage and the general poor appearance of the spruce.

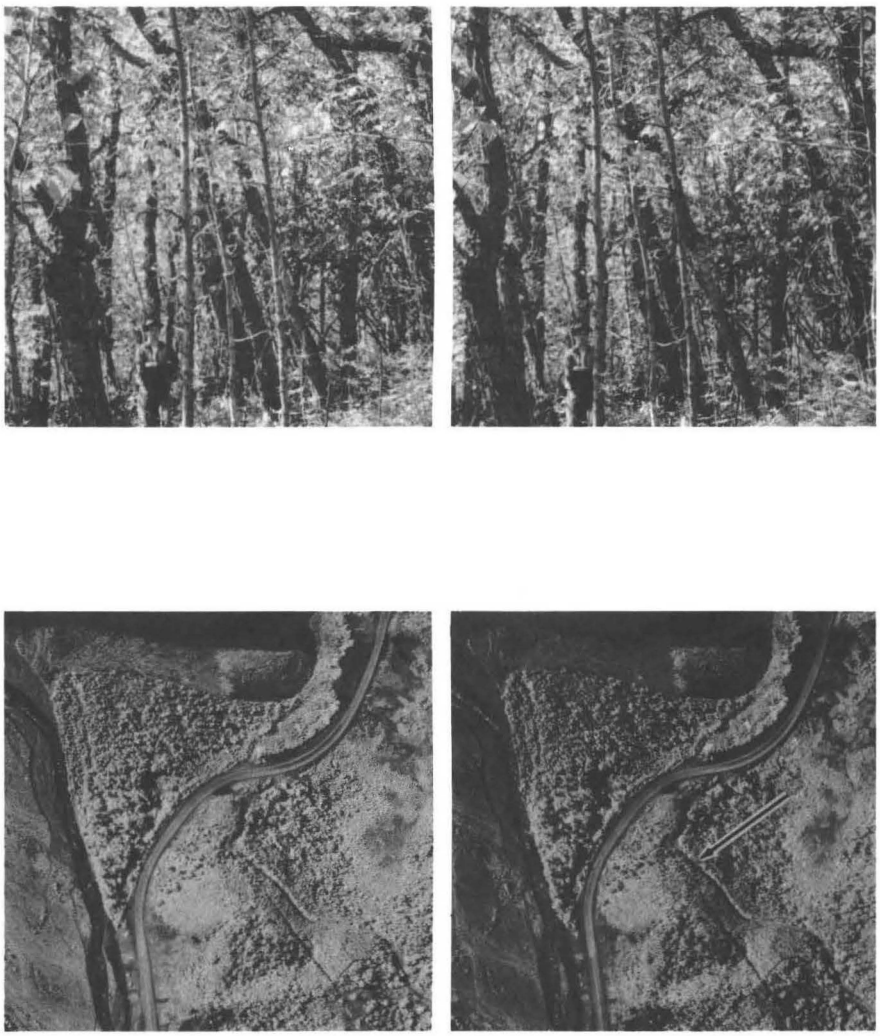


Figure 17. -- Mile 96 on the Glenn Highway, elevation 1,800 feet. Balsam poplar occasionally invades hillside sites after a fire, as has happened here. The slope is south-facing and too dry to support the type. The trees occupying this site are charred and twisted, with disproportionately large crowns. This condition is classified as offsite.

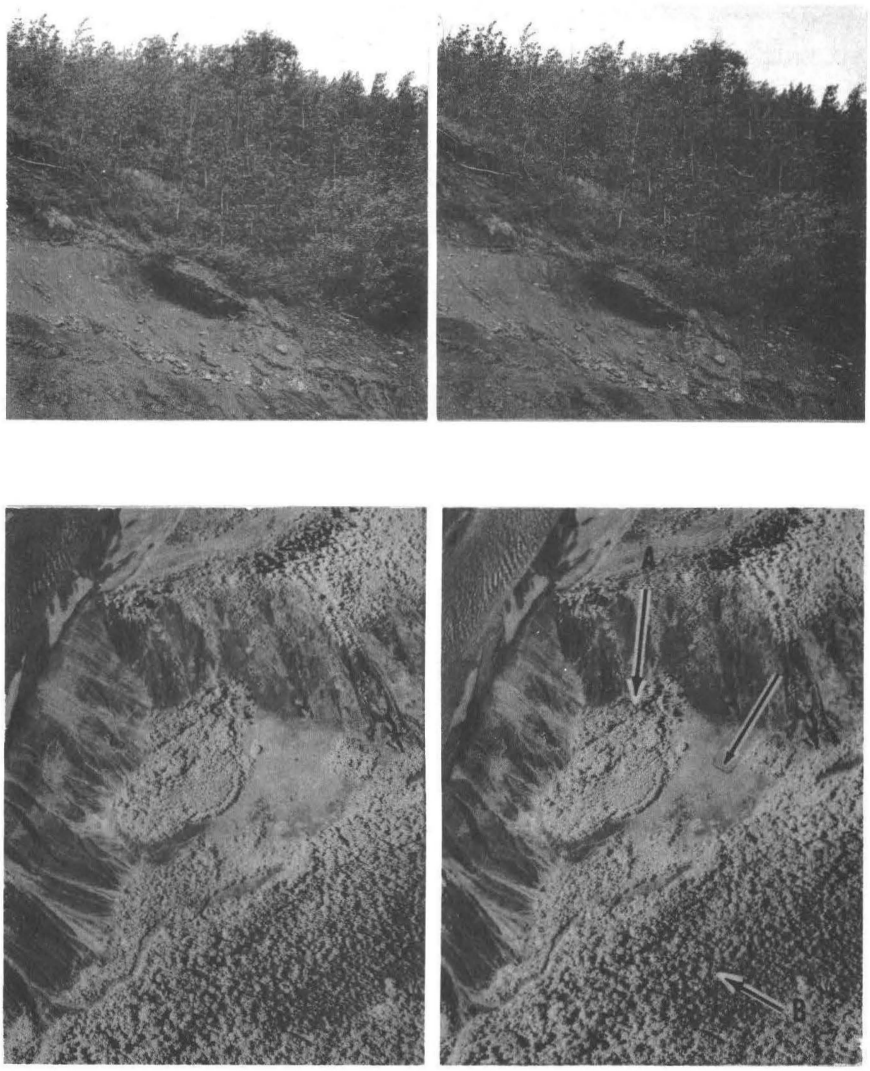


Figure 18.--Over-steepened, south-facing slope at Mile 96, Glenn Highway, next to the Matanuska River; elevation 1,800 feet.

(A) Noncommercial offsite aspen (ground stereo)
(B) Willow clumps on north-facing slope
(C) Dry meadow crossing contour lines

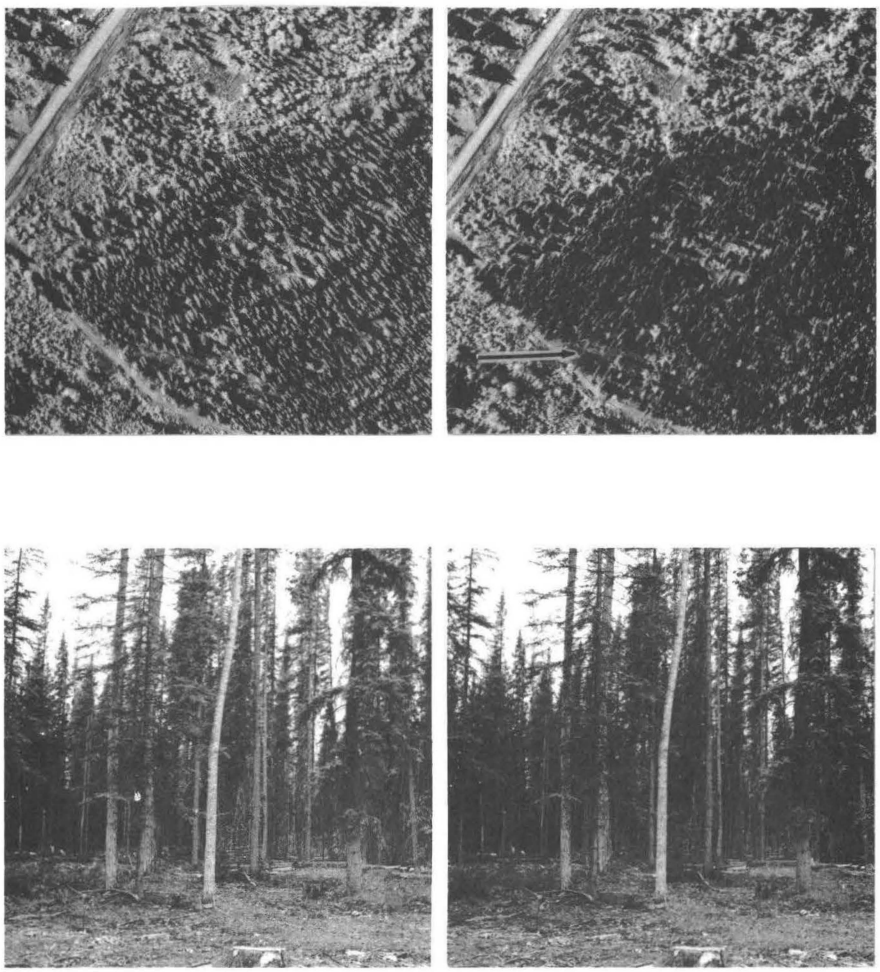


Figure 19.--A partially cut, spruce-balsam poplar sawtimber stand. Diameters range up to 15 inches and heights to 85 feet. The residual gross volume of this stand is about 5,000 board feet.

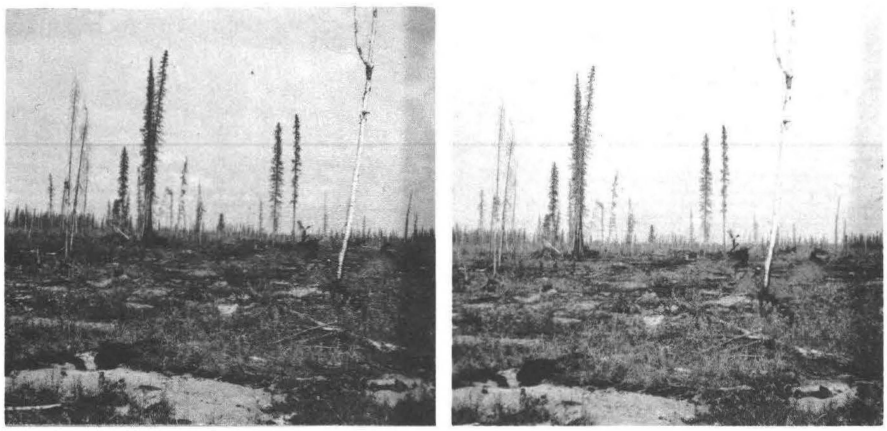


Figure 20.--Remnants of a spruce sawtimber stand with a birch understory. This picture was taken one year after the burn. Some salvaging has been done. From the air this stand appears similar to the air stereo below. In both cases a hot ground fire burned the root systems leading to an extensive blowdown.

This ground scene is about 15 miles east of Fairbanks on the Chena Hot Springs road.

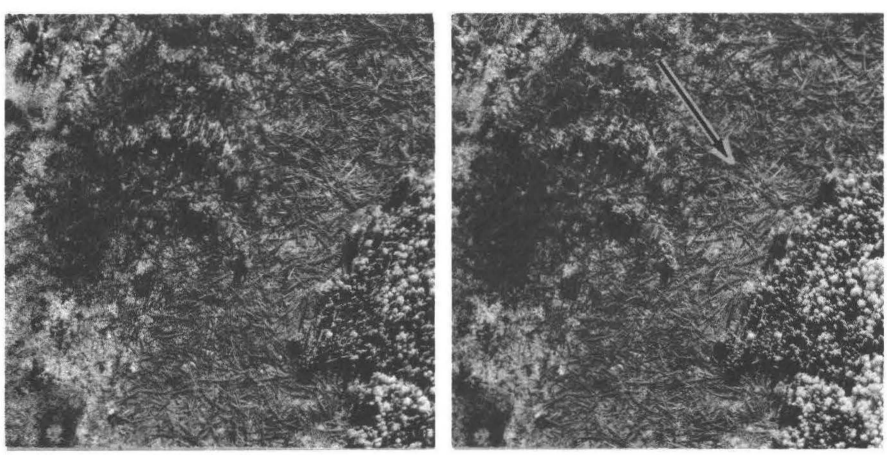


Figure 21. -- The air stereo above is of the Wood River drainage south of Fairbanks. The arrow points to the contrasting white-barked birch and the darker grey-toned spruce.

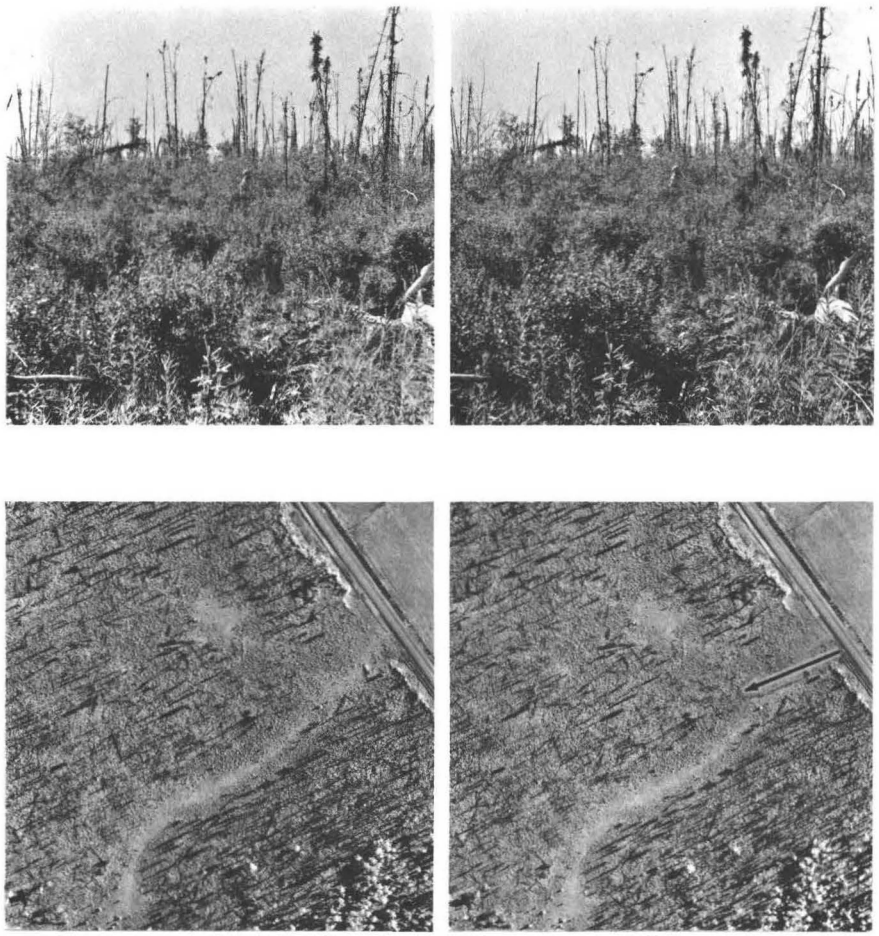


Figure 22.--Reproduction in the 421,000-acre Kenai burn of 1947. At this early stage of regeneration it is difficult, if not impossible, to identify the incoming species. This can best be determined from the surrounding remnants. If there are surviving spruce and few hardwoods in the area the site has probably returned to spruce. If hardwoods are in abundance with scattered spruce, the site has probably seeded back to hardwoods with a spruce understory. This stereo, taken in 1961, is an example of spruce seedlings with a brush-hardwood nurse crop. The more tolerant spruce will eventually become the dominant species.

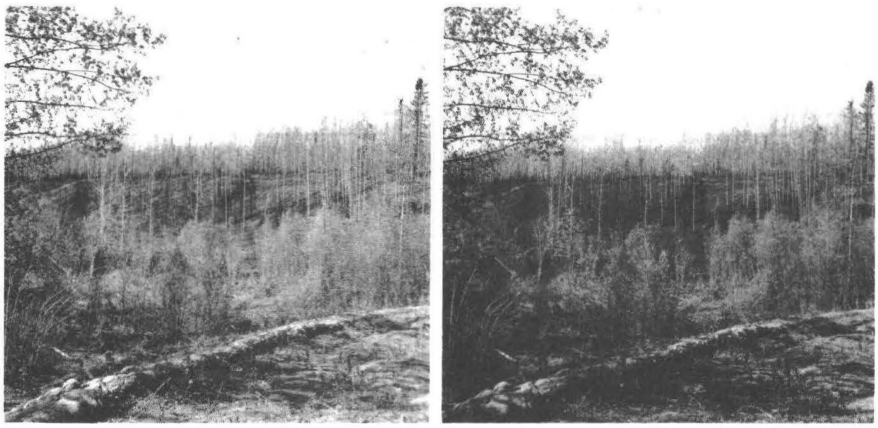


Figure 23.--Fire blackened this aspen stand in the background the summer of 1958. The fire was relatively light but of sufficient intensity to kill the sapling-size aspen in the area.

The stereo pair below was taken 3 years later. Aspen reproduction is 3-4 feet high and heavily stocked. Edgerton Highway near Copper Center.

Figure 24.--Fire swept through this stand of birch sawtimber one year before these pictures were taken. Some trees are still alive but apparently dying. No reproduction was found in the area.

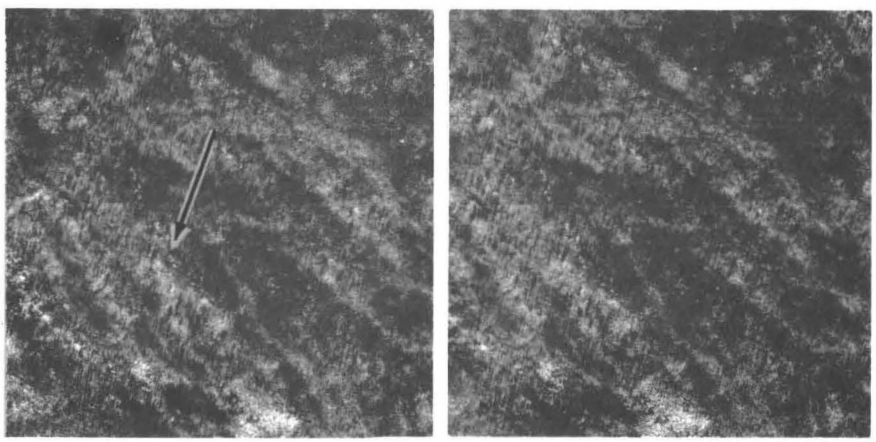


Figure 25.--A recent burn in a hardwood-spruce stand. Note the light-colored boles and very evident branching of the hardwoods as compared to the grey-black tone of the spruce.

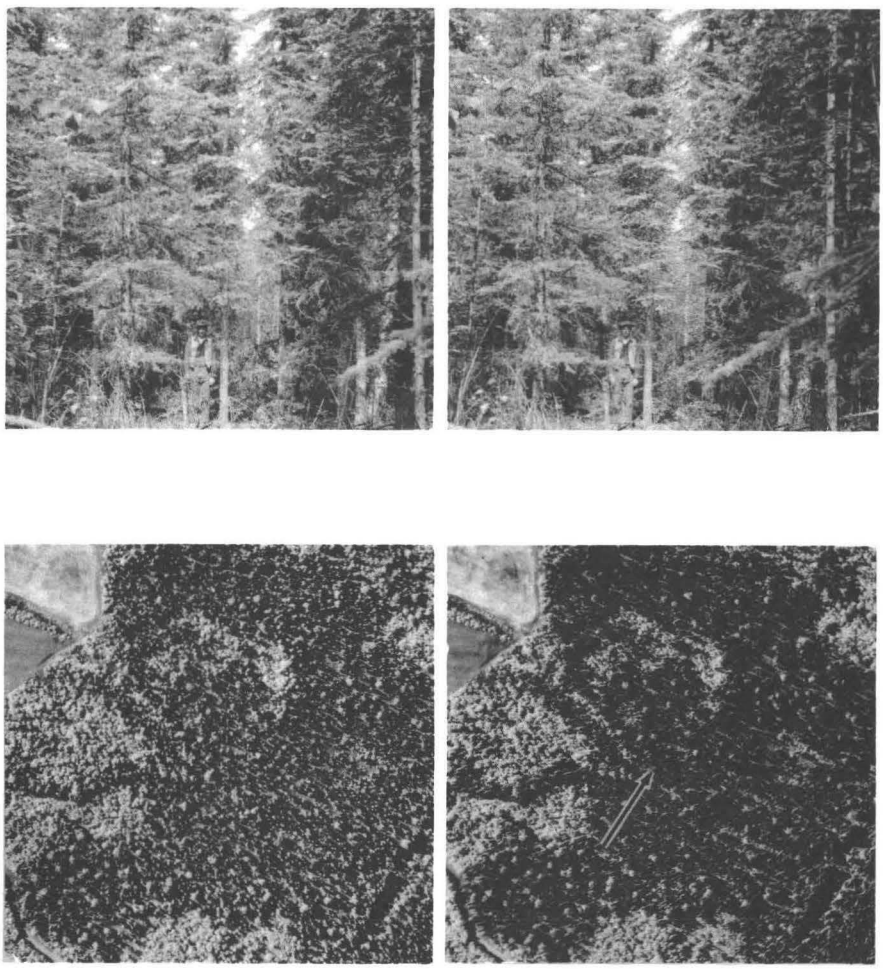


Figure 26.-- Spruce seedlings and saplings growing in mixture with sawtimber. The high reflectance of young spruce at this age makes them appear white and, therefore, difficult to distinguish from hardwoods.

For a view of seedling restocking refer to stereogram (fig. 22).

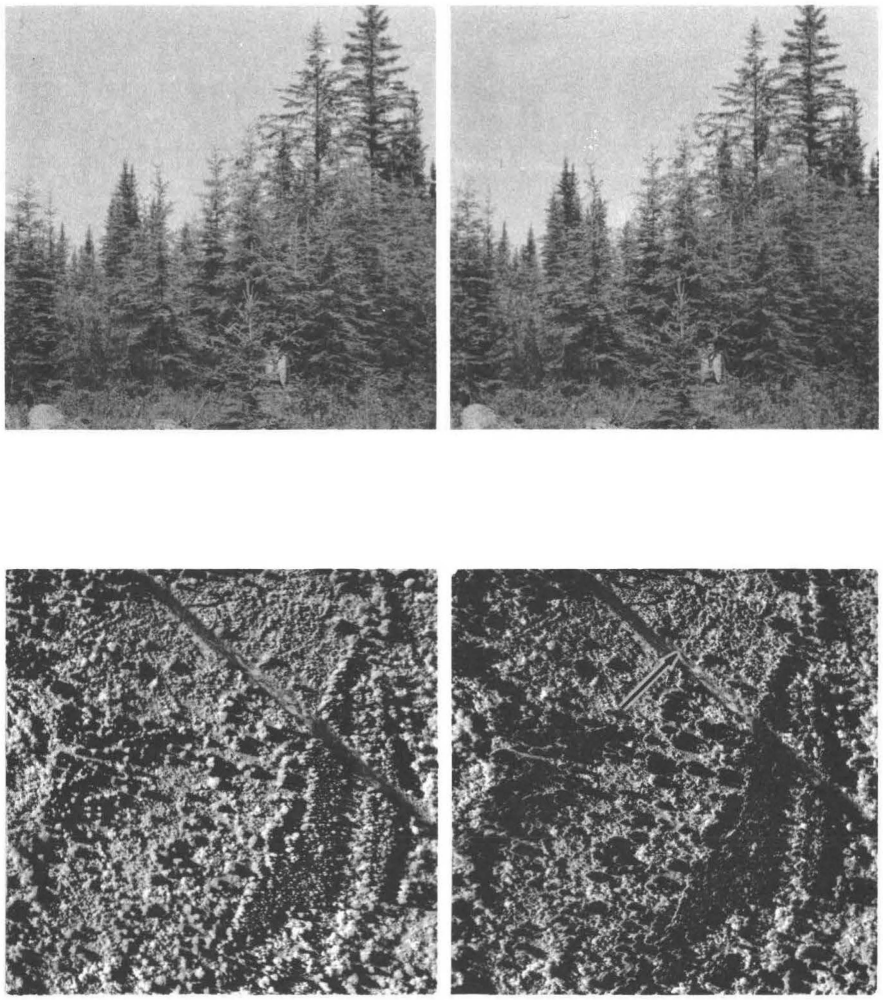


Figure 27.--A spruce poletimber stand near the Chena River. Average height of the stand is about 55 feet. Gross volume is 575 cubic feet. Note the relationship of crown width to tree diameter. Compare to sawtimber in figure 28.

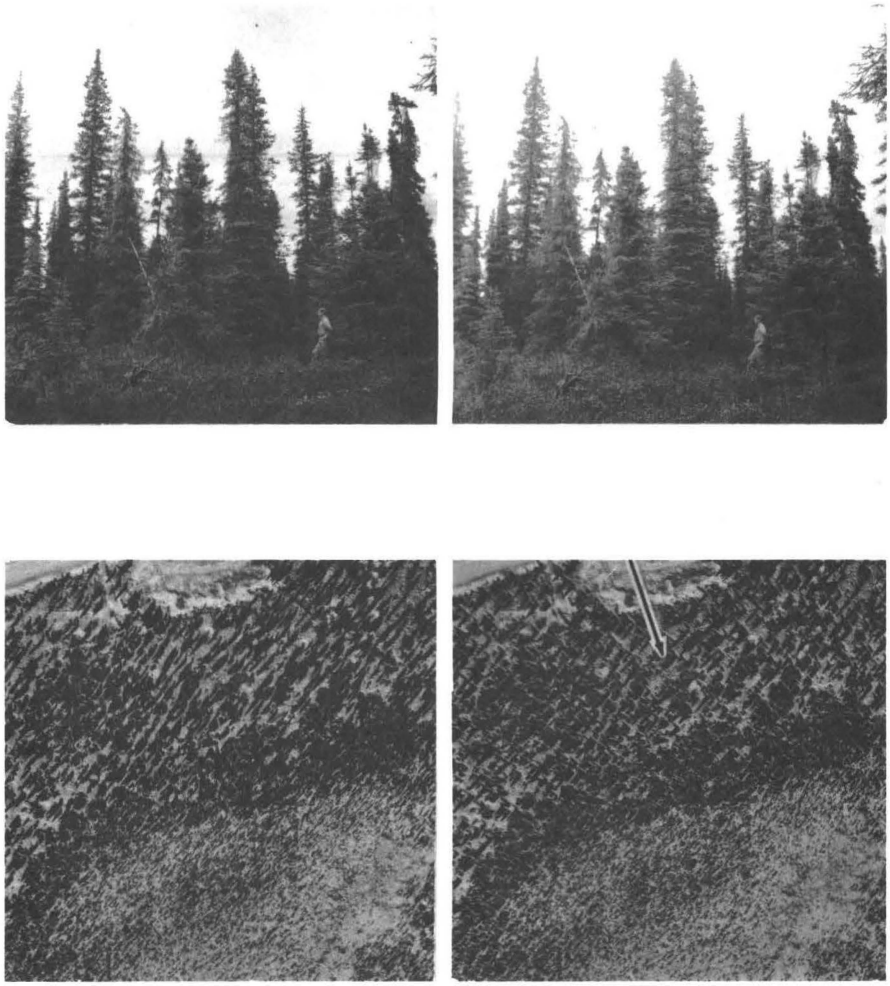


Figure 28.--An open-grown stand of spruce poles. The individual stems are thrifty, but the stand has not yet attained full stocking.

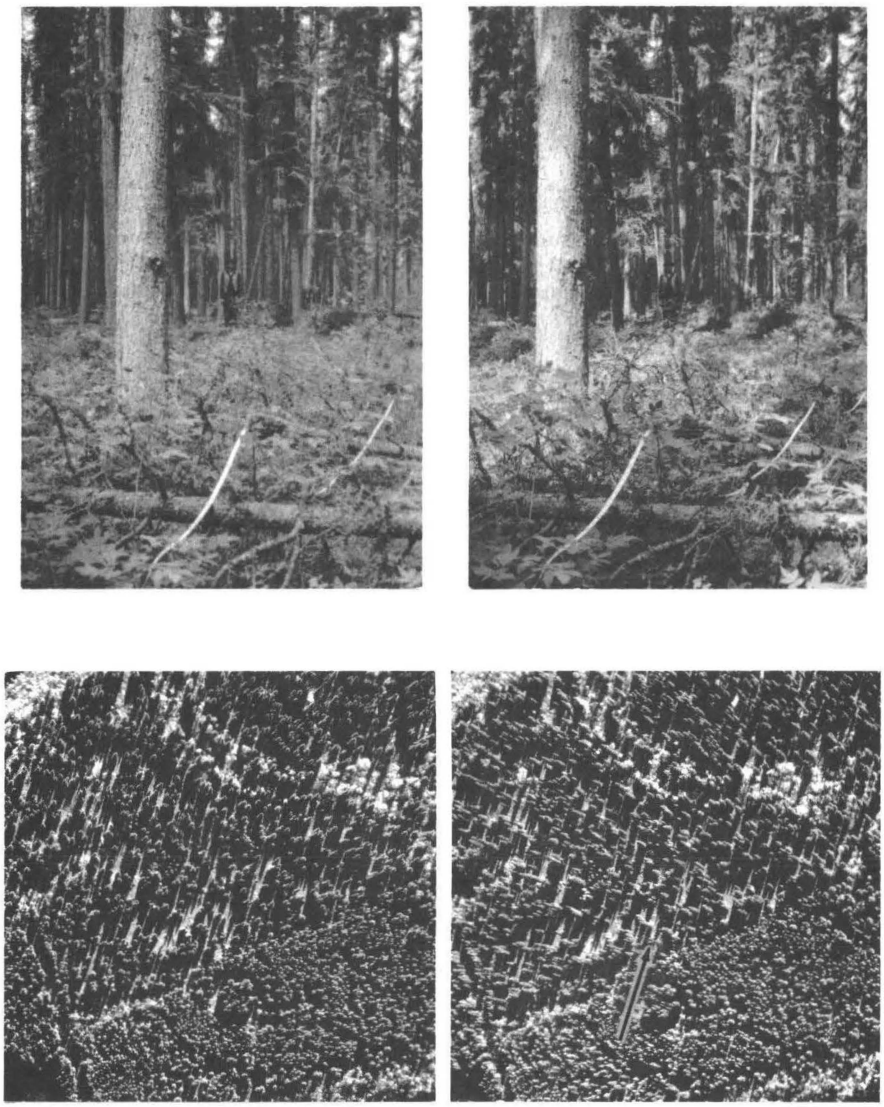


Figure 29.--Spruce sawtimber on the Chena River drainage southeast of Fairbanks. Diameters of the sawtimber trees range from 9 to 13 inches. Gross volume on a plot taken here was about 14,000 board feet per acre Int.1/4". The coarse texture and low stocking are typical of old-growth spruce.

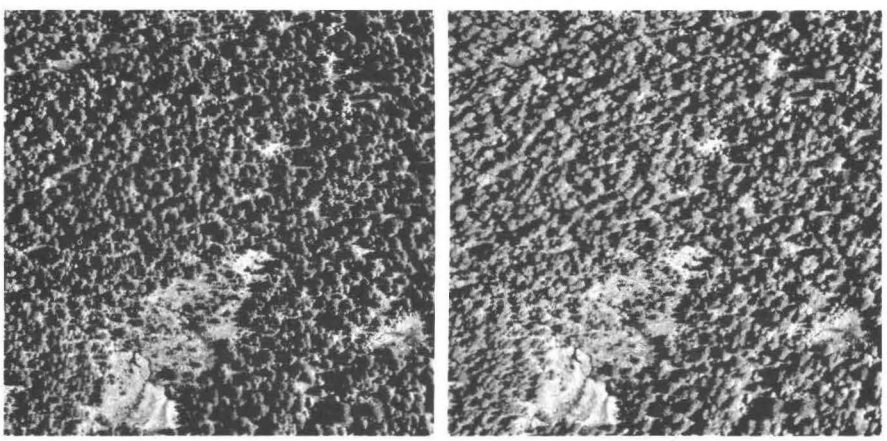


Figure 30.--The large, jagged crowns of the Sitka spruce make it easy to identify. This species is found only on the southern portion of the Kenai Peninsula and the west side of Cook Inlet.

Figure 31.--Examples of aspen seedlings and saplings with understories of spruce that will, in time, replace the short-lived aspen.

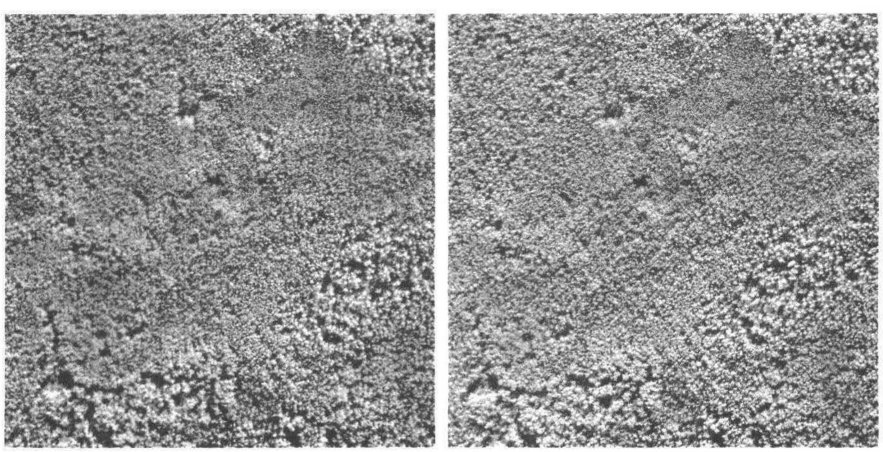


Figure 32.--An extensive stand of aspen seedlings and saplings on the Wood River drainage 50 miles south of Fairbanks.

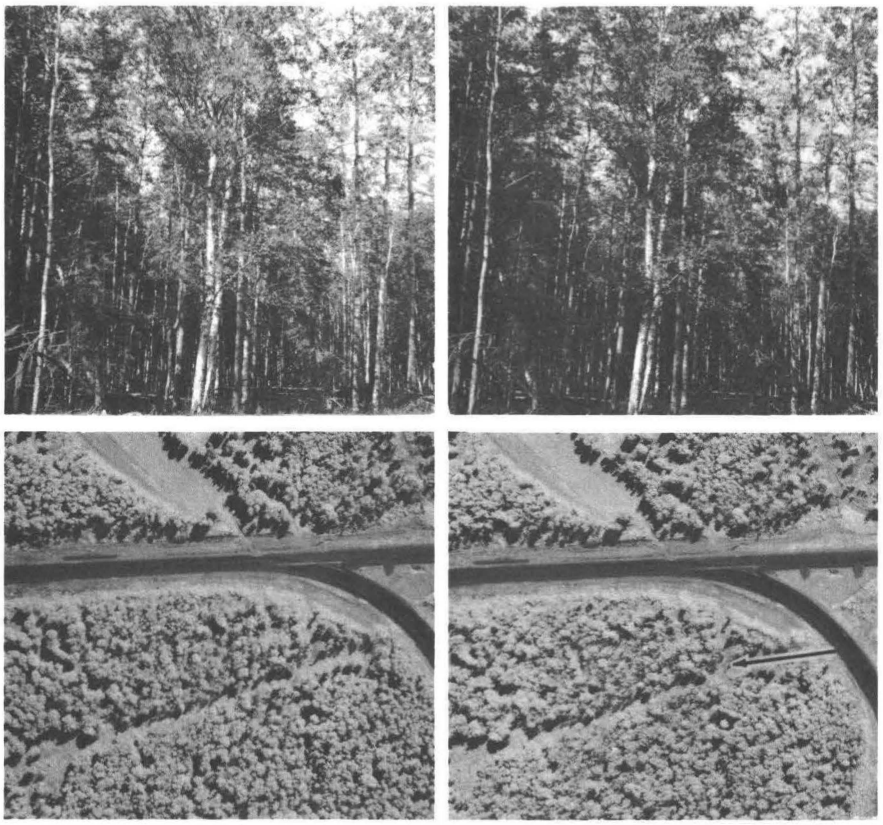


Figure 33.--An aspen-birch pole stand on the Kenai Peninsula near Soldatna. In more northern areas the two species grow on different aspects. Aspen is a common inhabitant of warm south slopes. Birch occupies southeast and southwest slopes that have a more abundant supply of moisture.

Figure 34.--An aspen pole stand with an understory of spruce. Few of the aspen stands in the Interior are as clear boled as those above.

Figure 35.--Remnants of an aspen sawtimber stand on the Chena Hot Springs road east of Fairbanks. Stands of this size are rare. This is partly due to fires and the rapid deterioration of overmature aspen. Diameter of tree in center is 18 inches, height 75 feet.

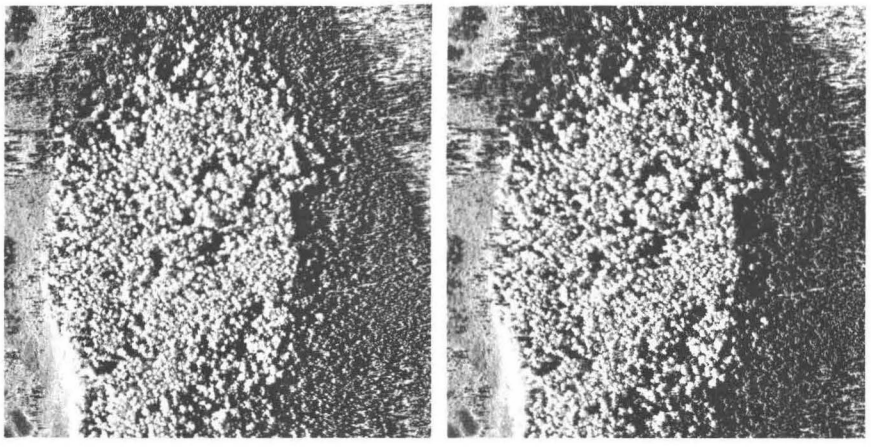
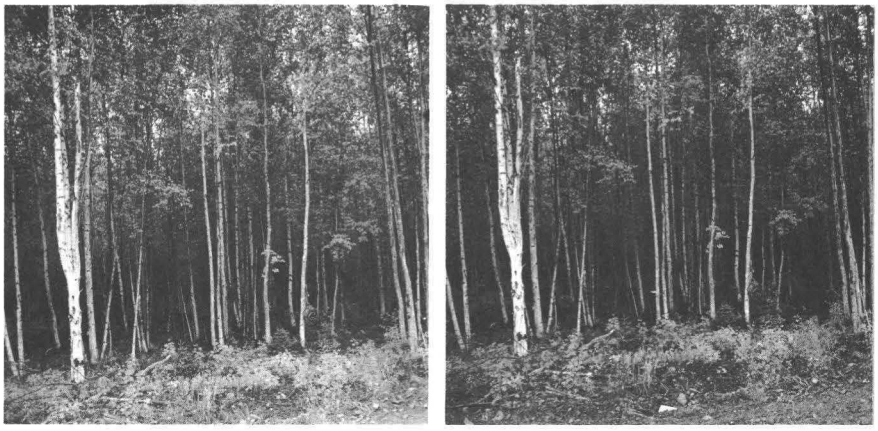


Figure 36.--A patch of aspen sawtimber-poletimber on the Kenai Peninsula near Kenai. The dominants are about 75-80 feet in height.



An example of the stand composition as shown in the air stereo at point A below.

The presence of the understory spruce in this birch stand causes the abnormally dark tone as it appears in the air stereo at point B.

Figure 37.--Steese Highway 50 miles northeast of Fairbanks. Stand composition is birch, aspen, and spruce S & S.

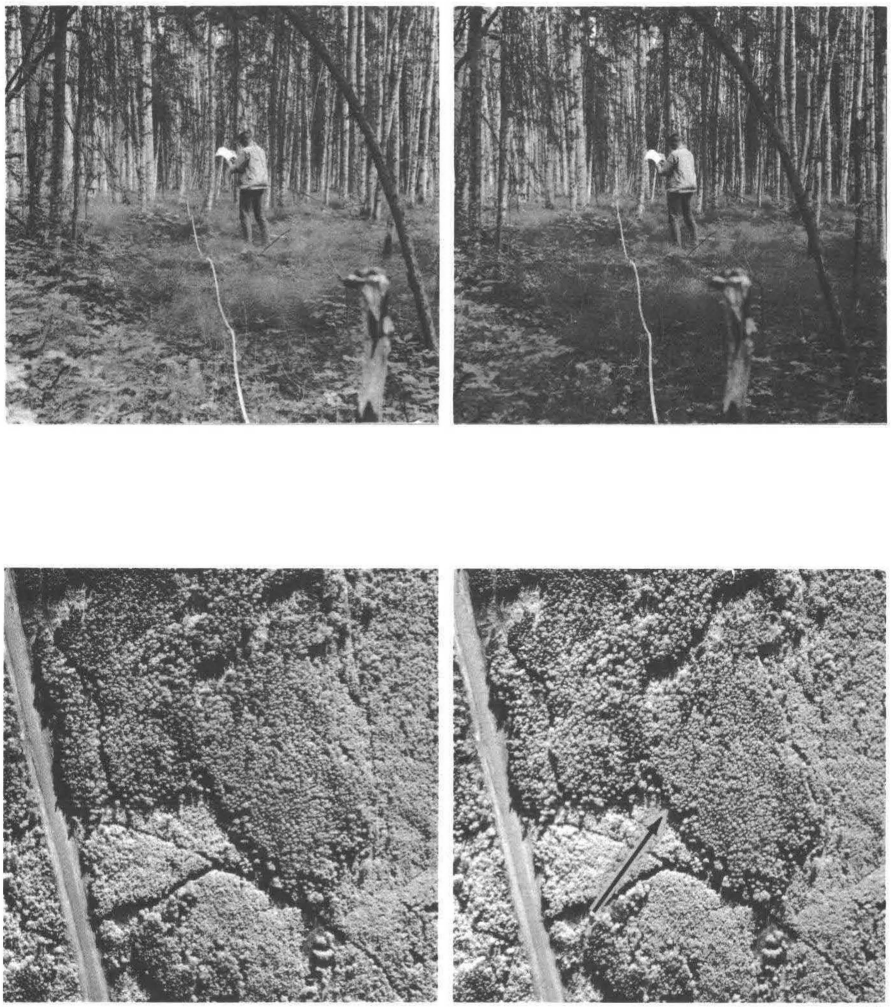


Figure 38.--A well-stocked stand of birch poles. The average height is 70 feet and the diameters range from 7-9 inches. This stand is near Fairbanks on the Chena Hot Springs road.

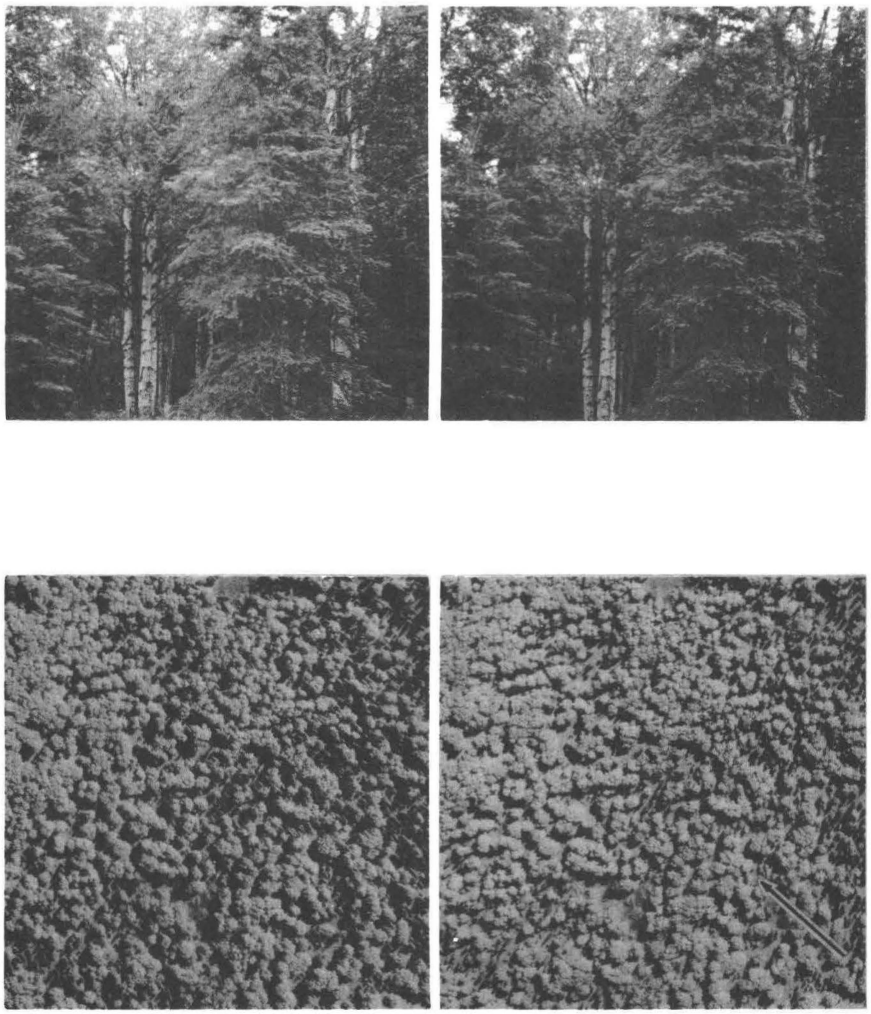


Figure 39.--Sawtimber birch near Soldatna on the Kenai Peninsula. Although the average height of the stand is only slightly over 60 feet, natural mortality and the associated low density has led to a corresponding increase in the diameter growth. The tree in the foreground has a diameter of 13 inches.

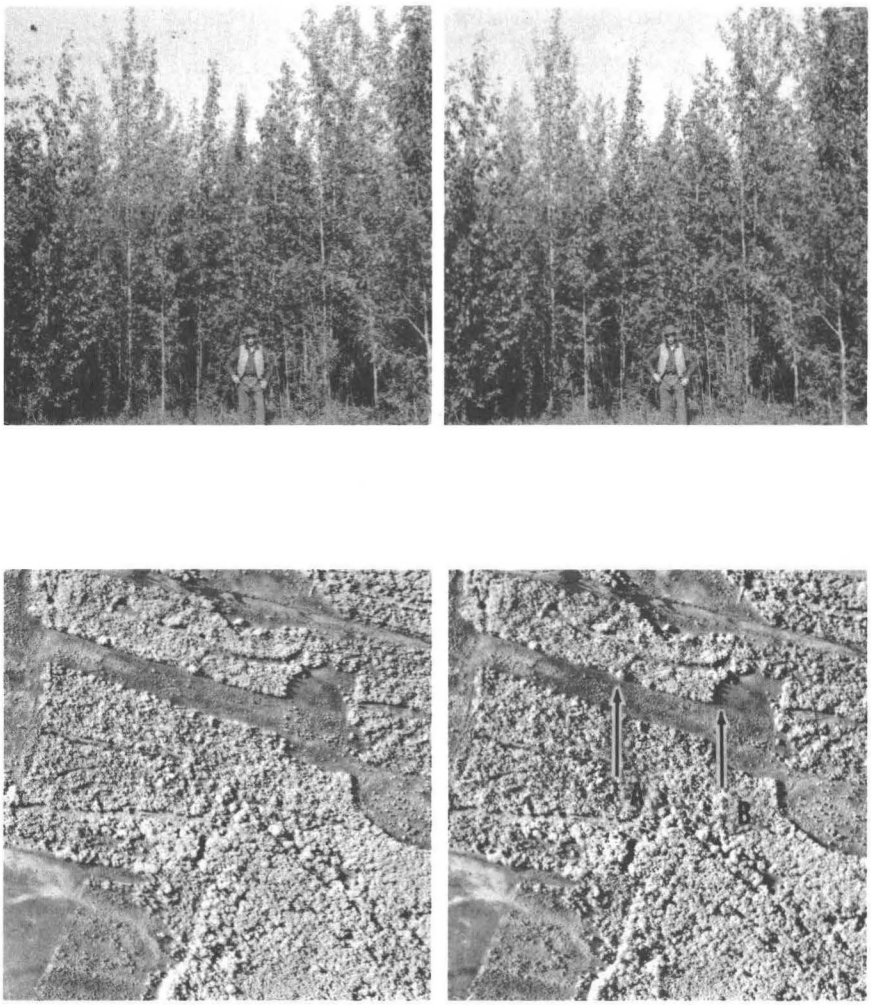


Figure 40.--Even at the large scale of these photos it is difficult to separate the species when in the seedling or sapling stage. This area near the Chena River was identified by adjacent mature trees. Note the jagged crown at (A), the jagged shadow at (B), balsam poplar S & S.

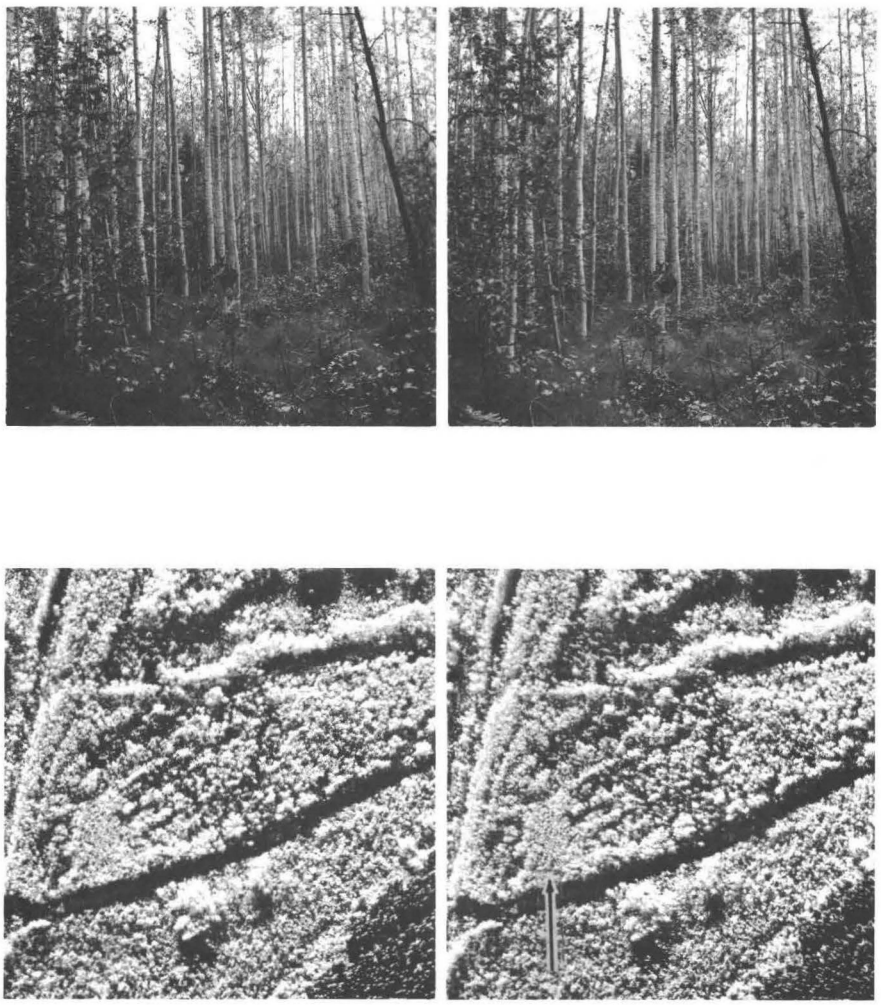


Figure 41.--A vigorous stand of balsam poplar poles growing on the Nenana River near Nenana. Diameters are 3-8 inches, heights about 60 feet. Note the finer texture and dense stocking of the stand as compared to figures 42 and 43.

Figure 42.--Balsam poplar poletimber with a scattering of sawtimber. (1) Poles 5-11 inches d.b.h., 70 feet in height. (2) Poles with sawtimber, dominants are about 75-80 feet in height. Chena River near Fairbanks.

It is extremely important in the hardwood stands of the Interior to give adequate consideration to the effect of density on diameter. Figure 35 illustrates this. The large, open-grown trees in the center of the photo are sawtimber size. Immediately above is a clump of poletimber of nearly equal height but at higher density. This same feature is illustrated in figure 41, preceding page.

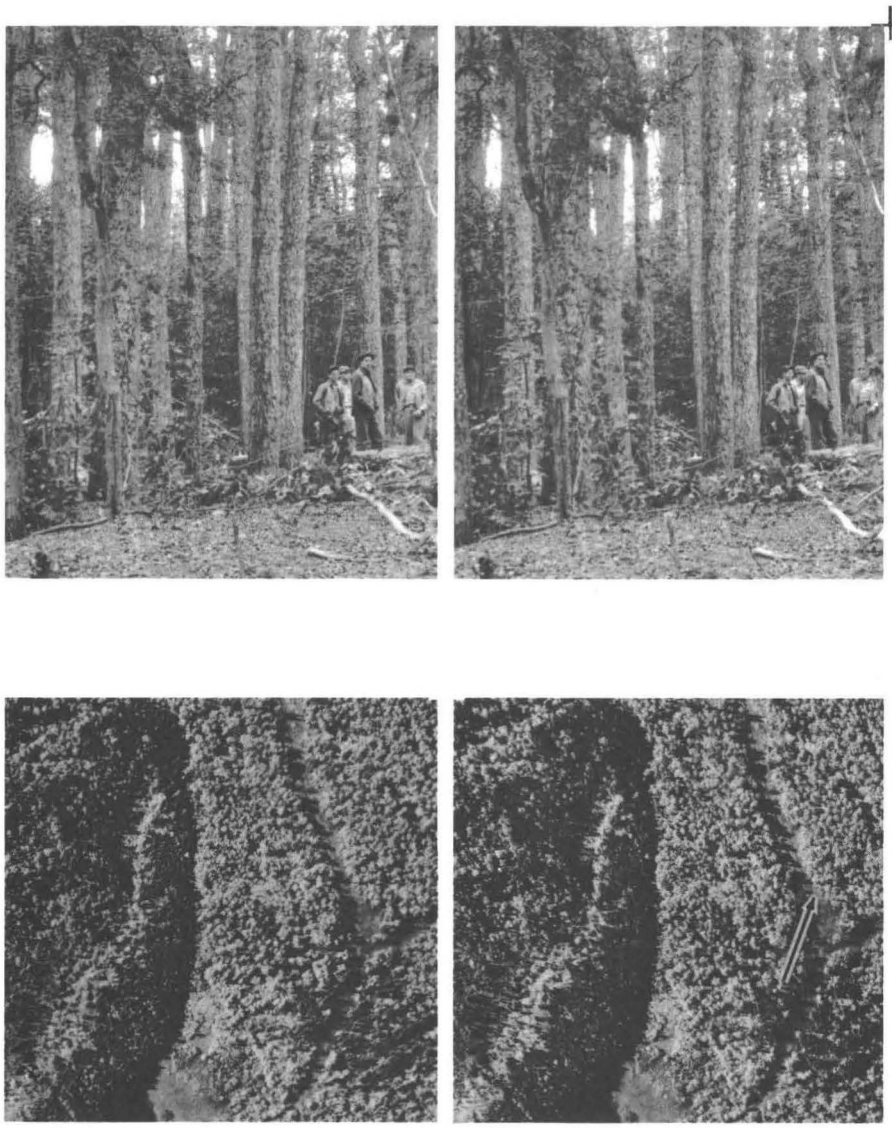


Figure 43. -- An old-growth (200 years) sawtimber stand of balsam poplar. The dominants in this area are 85 feet tall. Gross volume is about 25,000 board feet.

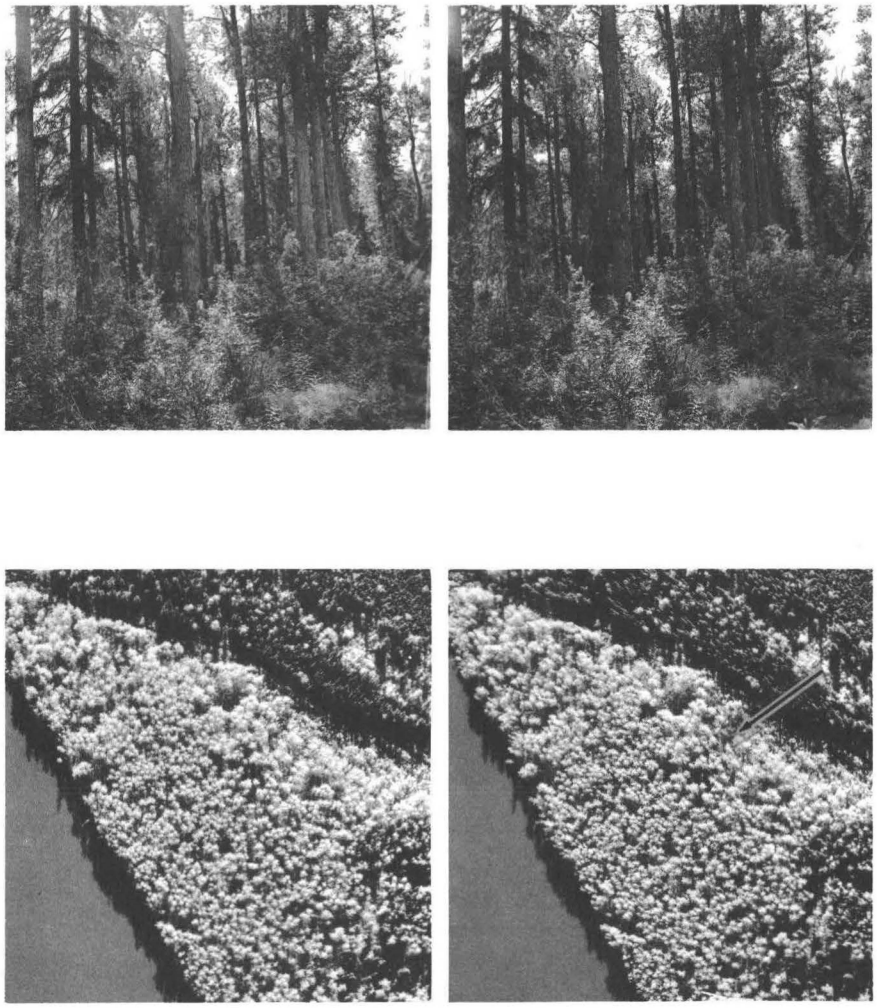


Figure 44.--An undisturbed stand of balsam poplar on the Tanana River. Diameter of the tree in the foreground is 36 inches. The height is about 90 feet.

Nonforest land. Land that does not qualify as forest land. Includes land that has never supported forests and lands formerly forested where forest use is precluded by development for nonforest uses such as crops, improved pasture, residential areas, and city parks. Also includes improved roads and certain areas of water classified by the Bureau of the Census as land. Unimproved roads, streams, canals, and nonforest strips in forest areas must be more than 120 feet wide, and clearings in forest areas must be more than 1 acre in size, to qualify as nonforest land.

Forest land. Land at least 10 percent stocked by forest trees of any size, or formerly having such tree cover, and not currently developed for nonforest use.

Commercial forest land. Forest land which is producing or is capable of producing crops of industrial wood and not withdrawn from timber utilization.

Noncommercial forest land. Unproductive forest land incapable of yielding crops of industrial wood due to adverse site conditions, and productive forest land withdrawn from commercial timber use through statute or administrative regulation.

Noncommercial forest land--offsite. Unproductive forest land incapable of yielding crops of industrial wood because of arid site conditions and which has been invaded by a commercial tree species.

Forest types. A classification of forest land based upon the predominant species in the present tree cover.

Spruce. Forests in which 50 percent or more of the stand is spruce. (Common associates include birch, aspen, and balsam poplar.)

Aspen/birch/balsam poplar. Forests in which 50 percent or more of the stand is aspen, balsam poplar, or paper birch, singly or in combination. (Common associates include white and black spruce.)

Commercial species. Tree species presently or prospectively suitable for industrial wood products; excludes so-called weed species.

Stand-size classes. A classification of forest land based on the predominant size of timber present, that is, sawtimber, poletimber, or saplings and seedlings.

Sawtimber trees. Live trees of commercial species 9.0 inches and larger in diameter at breast height for softwoods, and 11.0 inches and larger in diameter at breast height for hardwoods, and containing at least one saw log.

Sawtimber stands. Stands at least 10 percent stocked with growing-stock trees and with sawtimber trees making up a plurality of this stocking.

Poletimber trees. Live trees of commercial species 5.0 to 9.0

inches in diameter at breast height for softwoods and 5.0 to 11.0 inches in diameter at breast height for hardwoods, and of good form and vigor.

Poletimber stands. Stands at least 10 percent stocked with growing-stock trees and with poletimber trees making up a plurality of this stocking.

Saplings. Live trees of commercial species 1.0 inch to 5.0 inches in diameter at breast height and of good form and vigor.

Seedlings. Live trees of commercial species less than 1.0 inch in diameter at breast height that are expected to survive according to regional standards.

Sapling - seedling stands. Stands at least 10 percent stocked with growing-stock trees and with saplings and/or seedlings making up a plurality of this stocking.

Nonstocked areas. Commercial forest lands less than 10 percent stocked with growing-stock trees.

Special acknowledgment is made to members of the forest survey staff who aided in the preparation of this paper, and in particular to Paul M. Haack (now with the Pacific Northwest Forest and Range Experiment Station) who did much of the original organizational work.

Hegg, Karl M.
1966. A photo identification guide for the land and forest types of interior Alaska. Northern Forest Exp. Sta., Juneau, Alaska. 55 pp., illus. (U. S. Forest Serv. Res. Paper NOR-3)

A dichotomous elimination key, supported by ground and air stereograms, leading to the identification of the land and forest types of interior Alaska with the commercial forest type further identified by stand-size classes.

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